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A STATISTICAL STUDY OF INFANT MORTALITY.

By Edward Bunnell Phelps.

Considerably more than a generation ago (in 1865), Dr. Farr brought the subject of Infant Mortality before the [Royal] Statistical Society, and frequently discussed it in his historic contributions to the annual reports of the Registrar-General's office. On December 19, 1893, Dr. Hugh R. Jones read before the Royal Statistical Society an exhaustive paper on "The Perils and Protection of Infant Life," which had the distinction of being the Howard Medal Prize Essay of that year. In the interim of more than forty years since Dr. Farr inaugurated the statistical discussion, so to speak, infant mortality has been a prolific subject in medical works and journals, has received perennial treatment in the reports of practically all bureaus of vital statistics, and the bibliography of the subject even up to ten years ago would constitute quite an impressive library, were all the papers on, and extended references to, this particular phase of human mortality assembled and properly indexed.

In a general way, however, it may be said that only within the last few years has the topic been presented in such a light as to attract serious attention at the hands of the public at large, the discussion up to the end of the nineteenth century having practically been restricted to medical men, government officials, and professional statisticians. To be sure, as early as 1876 a Society for Nursing Mothers was established in France, and pro-

vision thus made on a small scale for caring for destitute mothers immediately before and after childbirth. The *Crèches* of France and the *Krippen* of Germany, or day nurseries, in part supported by private charity and in part by State or municipal aid, long since became well-known institutions. For many years both Germany and Switzerland have had laws prohibiting women from working in factories for certain periods before and after confinement, and providing for their partial support during those periods of compulsory idleness; and Section 61 of the Factory and Workshop Act (of 1901) of Great Britain enjoins factory employers from knowingly allowing women to work in their factories within four weeks of childbirth.

Furthermore, some fifteen years ago Nathan Straus began the establishment of his milk depots in New York City with a view to supplying pasteurized milk at nominal price for children's use, and since then the plan introduced by Mr. Straus has been copied in various quarters. But all of these institutions of nineteenth-century origin were the outcomes of individual realization of the growing importance of the problem of infant mortality, rather than of a public appreciation of its far-reaching bearing on the future of the race, and their establishment in no way controverts the previous statement that practically only since the dawn of the twentieth century has the subject been so brought forward as to attract serious attention at the hands of the thinking public.

The fact that such an era has now arrived is due to a variety of causes. In the first place, even the most pronounced cynic, if he be a well-informed and reasoning person, must admit that the community at large has begun to take more interest than ever before in "how the other half lives." So obvious and indisputable a truth calls for no demonstration, and the growing interest in "how the other half dies" is an inevitable corollary of the ascending interest in how the unfortunate or less fortunate section of the community lives. Perhaps this general development of the humanitarian instinct is primarily responsible for the civilized world's awakening to the appalling conditions of infant mortality. Men are beginning to realize

that the caste lines once so rigidly drawn between the various classes are, like most national boundaries in one sense at least, purely imaginary lines, and that the health and welfare of any one section of the community directly concern the health and welfare of the community at large. As Dr. Margaret Alden so well puts it in her very recent work on "Child Life and Labour," in the chapter on infant mortality (p. 16): "A thorough understanding of the subject should be the concern of every true citizen for three reasons: 1. Because such a wastage of human life is a loss of the nation's best capital. 2. Because the conditions which make for the death of infants, make also for disease. 3. Because this question appeals to us on humanitarian grounds."

By way of secondary, indirect, cause for the general dawning interest in the subject, probably the material advance in medical knowledge and in established principles of hygiene and sanitation has played the most important part. As an immediate result of this advance has come the gradual decrease in the general death-rate of recent years in practically all civilized countries, but as Dr. George Reid, Medical Officer to the Staffordshire County Council, points out in his contribution to the cyclopedic work on "Dangerous Trades" in the paper on "Infantile Mortality and Factory Labour" (pp. 84–85): "Although a steady decline has taken place in the general mortality of the country coincident with, and, no doubt, in the main, consequent upon sanitary progress, it cannot be said that the infant mortality has diminished in like proportion." That fact has been so generally noted, and so repeatedly emphasized, by both physicians and statisticians, that it could scarcely have failed to make at least some impression on the public mind. And now that it has been so graphically stated, as, for instance, in H. Llewellyn Heath's recent book on "The Infant, the Parent, and the State," small wonder is it that thoughtful people of all classes are beginning to realize that it is high time some united action were taken with a view to devising remedies for so anomalous a situation.

Mr. Heath's indirect indictment of the previous apathy on

the subject, on the first page of his book, is put in this blunt way: "In the year 1904, England lost 137,392 of her children before they had reached the short span of twelve months of life. The deaths of these infants constituted 25 per cent. of all the deaths in England and Wales during the year we are considering. Geneva has kept registers of births, marriages, and deaths since 1549. In the sixteenth century their infant deaths constituted 25.9 per cent. of their total deaths at all ages." In other words, as Mr. Heath thus makes clear, despite all the hygienic and sanitary progress of modern times, and despite the marked decline in the general death-rate, the ratio of infant mortality to total mortality remains practically the same in England and Wales to-day as it was in Geneva nearly three hundred and fifty years ago; and, it might be added, present conditions in the United States are only slightly better, the ratio of infant deaths to deaths at all ages in the registration States of this country in the last census year, as is shown in one of the tables accompanying this paper, having been no less than 20.06 per cent. as compared with Geneva's percentage of 25.9 more than three centuries ago.

The general tendencies in the direction of an increased public interest in the subject of infant mortality, above briefly outlined, of course have been materially supplemented and intelligently directed by the more or less frequent contributions to the discussion of Dr. Farr, Dr. Bertillon, Dr. Newsholme, Sir John Simon, Dr. Greenhow, Dr. Reid, Dr. Newman, and other statisticians and physicians; and so it happens that in the last three years no less than five congresses have been held in various European countries with a view to grappling seriously with the problems of infant mortality. The first of the five in question was an International Congress on the Functions of Infants' Milk Depots, which was held in Paris in October, 1905. The mayor of Huddersfield, the chairman of the Health Committee of Glasgow, and various other representatives from Great Britain attended the congress, and as the immediate result of their attendance a National Conference on Infantile Mortality was held at Westminster, on June 13–14, 1906. A complete steno-

graphic report of the proceedings of that conference has been published (London, 1906), and the demand for copies from all parts of the world was so unexpectedly large that the first edition of 3,000 copies was speedily exhausted, and a second edition made necessary.

In the preface to the second edition the Executive Committee thus summarizes the former apathy and the present general interest in infant mortality above alluded to: "The Conference of 1906 was the first attempt to bring before the public one of the most important of the many aspects of the social problem of physical and social degeneration. Prior to the Conference the problem of the appalling death-rate of infants under one year attracted only the attention of medical men—and merely a small proportion of that profession—and of a few philanthropists and social reformers, and the Executive Committee, who organized the Conference of 1906, hardly ventured to hope that their efforts would result in one of the most successful conferences, from a public health and social reform point of view, which has been held in this country." The conference was held in the rooms of the Westminster City Council, under the patronage of their Majesties King Edward VII. and Queen Alexandra. The Right Hon. John Burns, M.P., president of the Local Government Board, presided; and the chairman and vice-chairman, respectively, were Alderman Evan Spicer, M.P., chairman of the London County Council, and the Hon. Lord Provost of Glasgow, William Bilsland, Esq. The Lord Mayors of Liverpool, Manchester, Leeds, York, and Belfast, the Lord Provosts of Glasgow, Edinburgh, and Aberdeen, various other governmental officials, and some of the foremost medical officials of Great Britain served as vice-presidents of the conference, and the enlistment of these notables gave a decided impetus to the new movement. A second National Conference on Infantile Mortality, with an even more distinguished list of vice-presidents and delegates, was held at Westminster, March 23, 24, 25, 1908, and, largely as a result of the previous conference, the Notification of Births Act of 1907 was adopted by Parliament. A complete report of the proceedings and

papers of the second conference was also published (London, 1908).

Practically simultaneous with the first National Conference at Westminster, an exposition was held at Berlin for the purpose of inaugurating a comprehensive study of all the various phases of the infant mortality problem, and some idea of the scope of its work may be gained from the mere announcement that the exposition was continued for nearly three weeks. In its issue of Oct. 13, 1906, *Charities and the Commons* presents a summary of the work of the exposition, in part as follows: "Accompanying the exhibits were exhaustive explanatory leaflets and monographs by the most celebrated specialists, and a catalogue containing every possible and minute detail to instruct and enlighten. A bare outline even of the rich mass of material presented would go far beyond the limits of our space, and give subjects for numbers of articles. The striking feature of the exhibit is the increasing solicitude of governments to concern themselves in questions affecting the well-being and happiness of people, and the rapidly increasing co-ordination between private, or voluntary, and civic and national, or authoritative, reforms. The conditions of infant mortality in the German Empire have for a long time and with reason been the cause of grave anxiety to German social and political scientists, since statistics have been showing that, of the 2,000,000 infants born annually, 400,000, or one-fifth, do not survive the first year of existence. This disquieting fact has given rise to the founding of an institute, where, as a central point for the whole empire, the subject of infant mortality, its direct and accessory causes, will be studied with a seriousness worthy of the subject, and with all the co-ordinated thoroughness and science known to the German municipality and the German medical profession. From the side of medicine is to be given the fullest inquiry into physiological, and from the municipality into social, contributing causes."

In September, 1907, an international conference on the subject was held at Brussels, under the name of the Second International Congress of Gouttes de Lait, and it was decided that

its scope should be extended, and that the next congress should be termed the International Congress for the Protection of Infant Life. Were any further evidence of the increasing interest in the subject necessary, it possibly might be supplied by citing the fact that the subject selected by the Council of the Royal Statistical Society for essays in competition for the Howard Medal in 1908–09 is: "A Statistical Study of Infantile Mortality in Great Britain and Ireland, and of its Causes."

Even this brief summation of recent movements—movements international, governmental, and statistical—in the direction of trying to discover some means of coping with the substantially stable death-rate among young children the world around, makes it evident, it seems to the writer, that the subject of infant mortality has at last begun to impress its importance upon the thinking element of the civilized world, and will unquestionably receive more and more attention in the next few years. In view of that fact a review of the subject from an up-to-date statistical stand-point may not be inopportune. As above noted, the compilation of vital statistics in Geneva dates back to 1549, and it might almost be said that from that time down to date there have been more or less complete compilations of the statistics of infant mortality. In England local statistics on those lines are practically co-existent with the Registrar-General's office, the Massachusetts statistics of infant mortality for an even half-century are presented in a table accompanying this paper, and about eighteen years ago Dr. Jacques Bertillon prepared for the Encyclopédie d'Hygiène et de Médecine Publique a compilation of infant mortality statistics for the various countries of Europe, dating back as far as 1862 in one case.

The annual reports of the Registrar-General's office contain abstracts of the infant mortality rates of all the leading countries of the world, substantially down to date, and Dr. George Newman's recent work on "Infant Mortality—A Social Problem," contains a mass of statistical information reprinted from various sources. The Tenth, Eleventh, and Twelfth Census

Reports, and the three subsequent Special Reports of the Census Office inaugurating the prospective annual reports of mortality statistics of this country, present a great array of information—such as it is—regarding deaths of children under the ages of 1 and 5 in the United States, and the reports of all the countries and States having bureaus of vital statistics also contain more or less data along these lines. Consequently, there has been no lack of infant mortality statistics for the last fifty years and more, but, so far as the writer is aware, there has been no previous accumulation of this widely scattered information in such a way as to permit of any reasonably accurate, up-to-date, international comparisons of the mortality among infants. As subsequently noted, the statistics of the United States at large are wofully defective, and in the case of nearly all the registration States the margin of error is unquestionably a wide one, but by means of various methods of comparison an effort has been made to reduce the statistics of this country to a fairly accurate basis, and it is hoped that a workable plan of contrasting the infant mortality rates of the United States and other countries has been found. Unless otherwise specified, the term "infant mortality rate," wherever used in this paper, is to be construed as invariably referring to the rate of deaths under 1 year per 1,000 births—still-births excluded.

The table of Dr. Bertillon, above mentioned, is generally recognized as the earliest fairly accurate summary of the infant death-rate in Europe, and perhaps may best serve as the starting-point of this statistical review of the subject. Under the heading of "Tableau LXXXIII, Mortalité de 0 à 5 ans dans les principaux pays de l'Europe," it appears in Bertillon's chapter on "Démographie" in the Encyclopédie d'Hygiène (vol. i, p. 254), and, rearranged so as to present the various European countries in the order of their several death-rates under age 1, is as herewith reproduced. In its original form the table presents the supposed figures of the late '70's for Massachusetts, Rhode Island, and Vermont, which are omitted in the appended transposed reprint.

TABLE I.

MORTALITY FROM 0 TO 1 AND 0 TO 5 YEARS IN THE PRINCIPAL COUNTRIES OF EUROPE PRIOR TO 1883, ACCORDING TO THE BERTILLON TABLE.

Countries.	Period of Observation.	Of 1,000 Born Alive, Died under 1 Year.	Of 1,000 Born Alive, Died under 5 Years.
Ireland	1865–83	95.9	164.6
Norway	1866–82	104.9	179.1
Scotland	1865–81	122.0	230.9
Sweden	1866–82	131.9	222.5
Denmark	1870–82	137.5	204.9
Greece	1878–82	137.7	264.5
Belgium	1867–83	148.2	253.2
England and Wales	1866–82	149.2	249.3
Portugal	1862	150.0	—
Finland	1878–80	164.9	—
France	1875–82	166.2	251.1
The Netherlands	1878–81	193.2	—
Switzerland	1869–80	195.2	266.3
Prussia	1874–82	207.8	316.2
Italy	1872–83	209.7	378.5
Alsace-Lorraine	1872–81	212.7	298.0
Croatia	1874–82	234.0	423.8
Roumania	1875–82	250.0	339 6
Austria	1866–83	255.3	389.9
Baden	1866–83	261.7	346.9
Russia in Europe	1867–78	266.8	422.9
Saxony	1865–70	270.0	373.5
Bavaria	1866–83	308.4	393.2
Würtemberg	1871–81	312.5	397.1

The totals are not given with the tabulation as presented by Bertillon, but, dividing the total of 4,685.7 deaths under age 1 for 24 countries and the total of 6,366.0 deaths under age 5 for 21 countries, it appears that the averages for the European countries in the period stated were 195.2 for deaths under age 1 and 303.1 for deaths under age 5. In a general way, such were the infant death-rates of Europe a generation ago, *if* the returns on which Bertillon's table was based were correct. The question which naturally follows a study of them is: How have the infant death-rates of the intervening years compared with those of from thirty to forty years ago, in view of all the humanitarian, hygienic, and medical developments of this latter period? In the main, the conditions favorable to

better health, and a reduced death-rate, have materially improved. Has there been a corresponding improvement in the general health of infants, and a corresponding decrease in the death-rate of the little ones? Only the official vital statistics of the various countries can answer those questions, and, as the following tables will demonstrate, the answer is a sadly disappointing one.

The first attempt of any importance to assemble information on these lines, subsequent to the preparation in 1890 of the Bertillon table above reproduced, was made by Dr. Julius Eröss, and its results embodied in a paper presented before the Section for Children-Hygiene of the International Congresses for Hygiene and Demography at Budapest in 1894, under the title of "Ueber die Sterblichkeitsverhältnisse der Neugeborenen und Säuglinge." The text and tables of Dr. Eröss's paper were subsequently published in the *Zeitschrift für Hygiene und Infectionskrankheiten*, the important work periodically published at Leipzig under the editorial direction of Dr. Robert Koch and Dr. C. Flügge, and the statistics therein presented form a connecting link, as it were, between those of the Bertillon table and the infant mortality figures up to 1905 especially compiled by the writer for this paper, and presented in subsequent tables. The statistical data of Dr. Eröss's paper as published in the *Zeitschrift* (vol. xix, pp. 371–392) begin with Table I (p. 372), showing the "Infant Mortality of 0–1 Year at Rate of the Living Born and the Total Mortality in Thirteen European States," which, we are informed, was compiled from the various statistical year books. Translating its percentage ratios into rates per 1,000, for the sake of conformity with all the other tabulations of this paper, and taking the liberty of substituting in the list of countries for the name of Sweden that of Norway, which investigation of the official figures for both countries proves to have been the country with which the figures given for Sweden were identified, the table is as follows:—

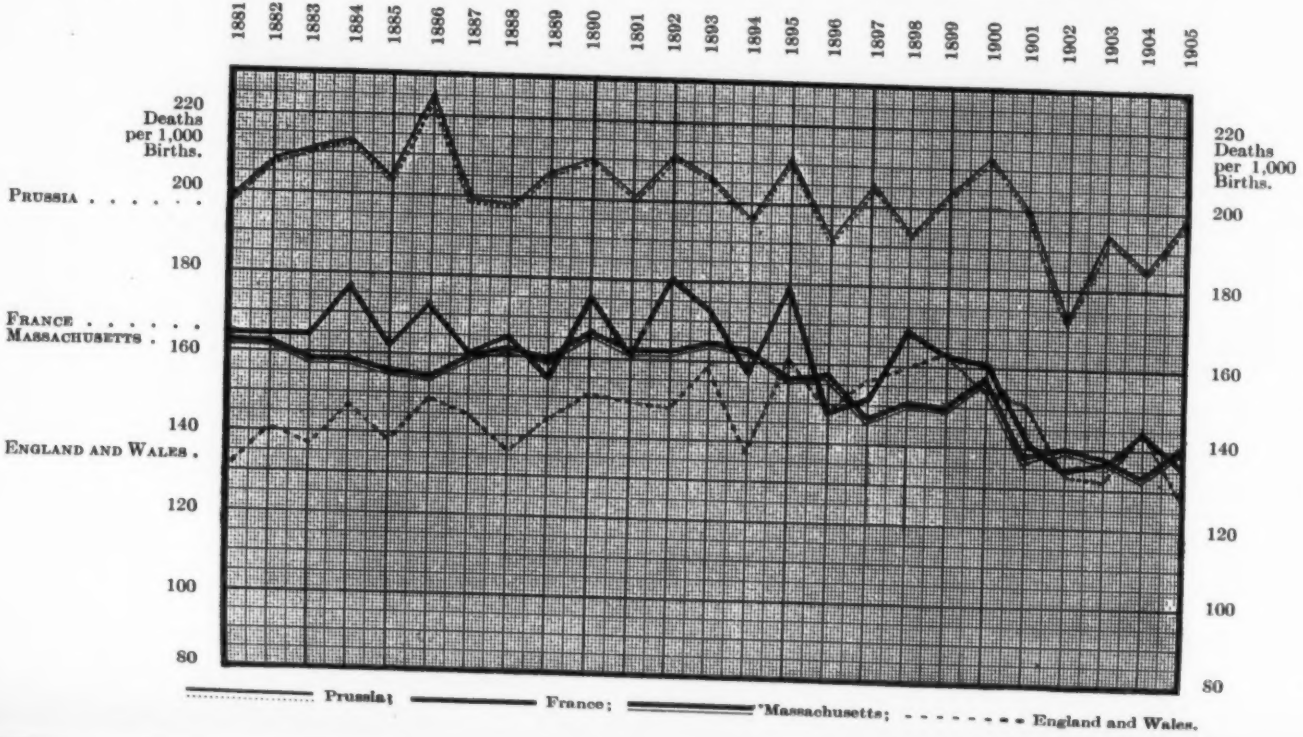
TABLE II.

BIRTHS, DEATHS UNDER AGE 1, TOTAL DEATHS, AND INFANT MORTALITY RATES PER 1,000 BIRTHS AND PER 1,000 TOTAL DEATHS, STILL-BIRTHS EXCLUDED, IN THIRTEEN OF THE PRINCIPAL EUROPEAN COUNTRIES, ACCORDING TO DR. ERÖSS'S TABLE.

Countries and Periods.	Number of Living Births.	Died under 1 Year.	Rate per 1,000 Births.	Total Mortality.	Rate of Deaths under 1 per 1,000 Total Deaths.
Ireland 1884–88	570,710	54,049	94	439,635	123
Norway 1881–90	600,489	58,471	97	331,209	176
Scotland 1885–90	745,986	89,858	120	446,179	213
England (and Wales) 1885–91	6,234,373	900,310	144	3,770,281	238
Belgium 1881–91	1,940,197	309,766	159	1,325,696	233
France 1885–90	5,337,880	882,909	165	5,049,223	174
Holland . . . . . {1880–82 / 1885–90}	1,332,266	239,466	179	817,216	293
Italy 1884–91	8,980,579	1,727,067	192	6,420,910	268
Prussia 1886–92	7,681,839	1,594,039	207	4,622,216	344
Hungary 1884–87	2,641,797	560,220	212	1,912,419	292
Austria 1886–87	1,765,541	435,763	246	1,350,760	322
Saxony 1886–92	987,248	277,857	281	639,208	434
Bavaria 1879–88	2,014,195	579,203	287	1,535,781	376
Totals	40,833,100	7,708,978	183	28,660,733	269

The periods of observation whose returns are presented in the above table in all cases overlap on the period with which the subsequent table for the last twenty-five years deals, and no detailed analysis of the tabulation of Dr. Eröss is necessary at this point, as its lessons are brought out with intensified force in the later table. That is to say, in this case, as in all cases, the greater includes the less. It may, however, be remarked, *en passant*, that all the countries included in the above table were also named in the Bertillon table, with the single exception of Hungary, and that the average infant mortality rate per 1,000 living births in those twelve countries in the period covered by Bertillon's table was 186, as compared with 187 in the period with which Dr. Eröss dealt. This startling inflexibility of infant mortality rates, when measured by broad averages of either countries or periods, is discussed at some length on subsequent pages of this paper.

DIAGRAM I.—A GRAPHIC COMPARISON OF THE ANNUAL FLUCTUATIONS IN THE INFANT MORTALITY RATES OF ENGLAND AND WALES, PRUSSIA, FRANCE, AND THE STATE OF MASSACHUSETTS, FOR THE TWENTY-FIVE YEARS, 1881–1905, INCLUSIVE, ON THE BASIS OF DEATHS UNDER 1 YEAR PER 1,000 BIRTHS, STILL-BIRTHS EXCLUDED.



For many years the annual reports of the Registrar-General have presented the most compact abstracts anywhere obtainable of the birth-rates, marriage-rates, death-rates, and death-rates under 1 year to each 1,000 children born, in practically all the European countries—and certain countries in other sections of the world. Taking those tables in the current (sixty-ninth) annual report as a basis, the writer has prepared the following tabulation, which affords a comprehensive picture of the infant mortality experience of the principal countries of Europe and Australasia for the last quarter of a century. The Registrar-General's report announces that in each case the figures were obtained from the statistical department of the country named, and that still-births have been eliminated in the case of both births and deaths, and in the preparation of the following tabulation the birth-rates and infantile death-rates for each five-year period named have been obtained by adding the rates for the 5 years and dividing the totals by 5. The general averages for the entire period under observation have been deduced by adding all the annual rates given in each case, and dividing the total by the number of years which each total represents. Had the actual *numbers* of births and deaths for each year for each country been available—as was the case with the restricted table of Dr. Eröss—instead of the birth-*rates* and death-*rates*, the five-year and total averages of course would have been slightly more exact, but the death figures are not given in the Registrar-General's returns from other countries, and, doubtless, the margin of error is so narrow as to be practically inappreciable. So explained, the tabulation in question speaks for itself, and is as follows:—

TABLE III.

BIRTH-RATES, AND DEATH-RATES UNDER AGE 1 PER 1,000 BIRTHS, OF THE PRINCIPAL FOREIGN COUNTRIES FOR THE LAST TWENTY-FIVE YEARS, BY FIVE-YEAR PERIODS AND FOR THE ENTIRE TWENTY-FIVE YEAR PERIOD—STILL-BIRTHS EXCLUDED IN BOTH CASES.

Countries.	1881–85.		1886–90.		1891–95.		1896–1900.		1901–05.		Averages, 1881–1905.	
	Births per 1,000 of Population.	Deaths under 1 per 1,000 Births.	Births per 1,000 of Population.	Deaths under 1 per 1,000 Births.	Births per 1,000 of Population.	Deaths under 1 per 1,000 Births.	Births per 1,000 of Population.	Deaths under 1 per 1,000 Births.	Births per 1,000 of Population.	Deaths under 1 per 1,000 Births.	Births per 1,000 of Population.	Deaths under 1 per 1,000 Births.
Norway	31.2	99	30.8	96	30.2	98	30.2	96	28.6	81	30.2	94
Ireland	23.9	94	22.8	95	23.0	102	23.3	106	23.2	98	23.2	99
Sweden	29.4	116	28.8	105	27.5	103	26.9	101	26.1	92*	27.7	104*
Bulgaria	37.0	81	36.1	95	37.7	140	41.3	143	40.9	145*	38.6	120*
Scotland	33.3	117	31.4	121	30.5	126	30.0	129	28.9	120	30.8	123
Denmark	32.4	134	31.5	137	30.4	139	30.0	132	29.0	119	30.7	132
Finland	35.5	162	34.5	144	31.8	145	32.6	139	31.4	131	33.2	144
England and Wales,	33.5	139	31.4	145	30.5	151	29.3	156	28.1	138	30.6	146
Switzerland	28.6	171	27.5	159	27.7	155	28.5	143	28.1	134	28.1	153
Belgium	31.1	156	29.5	163	29.2	164	28.9	158	27.7	148	29.3	158
Servia	46.3	157	43.7	158	43.3	172	40.0	159	38.8	149	42.4	159
France	24.7	167	23.1	166	22.3	171	22.0	159	21.3	139	22.7	160
The Netherlands	34.8	181	33.6	175	32.8	165	32.1	151	31.6	136	33.0	162
Italy	38.0	*175*	37.5	*175*	36.1	185	34.0	168	32.6	168	35.6	175*
Spain	36.4	193	36.0	186*	35.3	*185*	34.3	*185*	35.3	173	35.5	185*
Prussia	37.4	207	37.3	208	37.0	205	36.5	201	34.9	190	36.6	202
Roumania	41.8	182	40.9	195	41.0	220	40.2	216*	39.4	*203*	40.7	203*
Austria	38.2	*223*	37.8	*223*	37.5	*223*	37.3	226	35.6	213*	37.3	223*
Hungary	44.4	*226*	43.5	*226*	41.7	250	39.4	219	37.2	212	41.2	226*
Russia in Europe	49.1	271	48.2	264	48.2	276	49.3	261	*48.6*	*268*	48.6*	268*
Averages for Europe,	35.3	163	34.3	162	33.7	169	33.3	162	32.4	153	33.8	162
New Zealand	36.3	90	31.2	84	27.7	87	25.7	80	26.6	75	29.5	83
Tasmania	34.5	109	34.6	103	32.7	94	28.2	98	29.0	90	31.9	99
South Australia	38.5	*101*	34.7	105*	32.0	99	27.0	112	24.5	87	31.3	101*
Queensland	36.5	136	37.4	119	34.1	103	29.2	104	26.7	95	32.8	111
New South Wales	37.7	124	36.4	115	32.9	111	28.0	113	26.7	97	32.3	112
Victoria	30.8	122	32.7	131	31.0	111	26.2	111	24.9	96	29.1	114
Western Australia	34.5	*135*	37.0	123	31.4	130	27.9	160	30.3	126	32.2	135*
Averages for Australasia	35.5	117	34.9	111	31.7	105	27.5	111	27.0	95	31.3	108
Japan	26.0	104	28.5	116	28.6	147	31.1	153	31.8	154	29.2	135
Ceylon	28.6	158	30.2	158	31.7	169	37.1	168	38.6	171	33.2	165
Jamaica	37.6	158	36.7	170	38.4	171	38.9	175	39.0	174	38.1	169
Chili	39.4	*314*	35.2	264	37.2	336	34.1	333	35.2	332*	36.2	314*
Averages for Countries Named	32.9	184	32.7	177	34.0	206	35.3	207	36.2	208	34.2	196

RECAPITULATION.

Europe	35.3	163	34.3	162	33.7	169	33.3	162	32.4	153	33.8	162
Australasia	35.5	117	34.9	111	31.7	105	27.5	111	27.0	95	31.3	108
Other Lands	32.9	184	32.7	177	34.0	206	35.3	207	36.2	208	34.2	196
†Grand Averages	35.1	155	34.2	152	33.3	159	32.2	157	31.6	147	33.3	154

* Returns for one or more years wanting, and averages have been calculated on basis of returns for other years of period in question.

† Computed by division of totals for all countries represented in table by number of countries in question.

Italicized figures represent estimates for periods for which no returns were available, estimate in each case being average of actual returns for balance of entire twenty-five year period.

So far as the writer is aware, the preceding table is the first detailed comparison ever compiled of the birth-rates and infantile death-rates of the leading countries of the world by five-year periods for an entire quarter of a century, and the continuity of comparisons sheds considerable light on many mooted questions which have been raised in the protracted discussion of infant mortality. Unfortunately, in a few cases returns were wanting, and in order to round out the averages for the periods and countries in question it was necessary to substitute estimates for actual returns. As stated in the appended foot-note, however, all estimates for five-year periods were based on the averages of returns for the balance of the twenty-five year period, and the margin of error, therefore, is probably so slight as to make no material difference in the general showing.

The first and all-important point to be noted in the tabulation is the uniformity of the infantile death-rate for the world at large for the last quarter of a century, and its comparatively slight fluctuations by five-year periods in particular countries or sections of the world. Thus it will be noted, in the thirty-one widely remote countries for which returns are presented, in 1881–85 the rate of infant deaths per 1,000 births was 155, and in the period commencing twenty years later was practically identical, then standing at 154. As is shown by a subsequent table herein presented, the apparent infantile death-rate in this country in the States recognized as registration States at the time of the Twelfth Census was 144.7 in 1900 and 162.6 in 1890, thus averaging 153.7; and, as is demonstrated by another table showing the annual infant mortality rates in Massachusetts from 1856 to 1905, the average infant death-rate under age 1 per 1,000 living births in that Commonwealth for the last fifty years has been 152.4. Succinctly stated, the infantile death-rates for these various sections and periods were as follows:—

TABLE IV.

THE UNIFORMITY OF THE INFANTILE DEATH-RATE IN ALL SECTIONS OF THE WORLD IN RECENT YEARS.

Sections.	Periods of Observation.	Deaths under Age 1 per 1,000 Births.
31 Countries of Europe, Australasia, and other lands	1881–1905	154
Registration States of the United States in 1900 .	*1890 and 1900	153.7
State of Massachusetts	1856–1905	152.4

* Census years ending May 31.

In view of the many material changes in the living habits and industrial conditions of the world's population in the last generation, the great advance in medical knowledge, and the marked decrease in the general death-rate, the practical uniformity of the infantile death-rate the world around is simply astounding. On the face of the above showing it apparently has a regularity in keeping with that of the American Experience Table of mortality; and, bearing in mind the point noted in H. Llewellyn Heath's book,—namely, that in the sixteenth century the infant deaths constituted 25.9 per cent. of all the deaths at Geneva and in 1904 were 25 per cent. of all the deaths in England and Wales,—there is an almost weird suggestion of the pitiless inflexibility of Fate in the death-rate of infants. Of course there are wide variations in the infant death-rates of individual communities, but, as the tables herewith presented will show, the fluctuations in long-established and stable communities would seem to be comparatively slight, and, as has apparently been demonstrated by the preceding tables, when a really broad average has been attained the change in the infantile death-rate of the world at large in a long stretch of years apparently is almost infinitesimal.

In most, if not all, countries—and certainly in nearly all the States of the United States—there are more or less serious defects in the registration of vital statistics, especially in the recording of births. That subject has been so thoroughly

threshed out as to call for no comment here. But, to a certain extent, the defects of one country's registration system would be offset by the comparative perfection of that in force in some other country, in a tabulation of world-wide scope, and in the case of the twoscore countries and States dealt with in the last table it is not improbable that the percentage of error is substantially uniform. Even were the inquiry restricted to the two English-speaking sections whose registration systems are generally regarded as freest from defects—to wit, England and Wales on one side of the Atlantic and the State of Massachusetts on this side of the water—the variations in their infant mortality rates in the last twenty-five years and the averages for the entire period differ but slightly, the infant death-rates in England and Wales for the five latest five-year periods having been in the order of 139, 145, 151, 156, and 138, and those of Massachusetts for the same periods having been 160, 161, 161, 153, and 138. The widest range of five-year variation in the case of England and Wales was 18 per 1,000 births, and that in the case of Massachusetts 22 per 1,000 births. Their respective averages for the twenty-five year period were 146 and 154.

In the tabulation of infant mortality in the principal countries of Europe compiled and published in 1890 by Dr. Bertillon and reproduced in transposed form on a previous page of this paper, the latest date of observation was the year 1883,—that is to say, twenty-five years ago,—and some of the figures dated back to 1862. In those days the registration of vital statistics in many—if not most—of the countries of Europe was far less advanced than it has become of late years, and, taking into account the well-known fact that approximate completeness in the registration of deaths almost inevitably precedes that of registration of births, it might naturally be assumed that the apparent rates of infant deaths to births would have been much larger in the case of the records of 1862–1883 than in those of 1881–1905, the divisor in the previous calculation presumably having been much farther removed from the correct figure. As to how well founded that

assumption proves, the following comparison of the death-rates in the Bertillon table and that compiled by the writer of this paper will indicate.

Some considerable *apparent* decreases in the infant mortality rates of certain countries are to be noted in the following table,

TABLE V.

A Comparison of the Infant Mortality in the Principal Countries of Europe in the Last Twenty-five Years with the Earlier Periods Named in Bertillon's Table and the Decrease or Increase and Relative Rank in the Case of Each of the Countries.

	Infant Mortality in Periods Named.		Deaths per 1,000 Births, 1881–1905.	Decrease or Increase.	Rank in Order of Lowest Infant Mortality.	
	Period of Observation.	Deaths per 1,000 Births.			Early Period.	Later Period.
Ireland	1865–83	95.9	99	3.1*	1	2
Norway	1866–82	104.9	94	10.9	2	1
Scotland	1865–81	122.0	123	1.0*	3	4
Sweden	1866–82	131.9	104	27.9	4	3
Denmark	1870–82	137.5	132	5.5	5	5
Belgium	1867–83	148.2	158	9.8*	6	9
England and Wales	1866–82	149.2	146	3.2	7	7
Finland	1878–80	164.9	144	20.9	8	6
France	1875–82	166.2	160	6.2	9	10
The Netherlands	1878–81	193.2	162	31.2	10	11
Switzerland	1869–80	195.2	153	42.2	11	8
Prussia	1874–82	207.8	202	5.8	12	13
Italy	1872–83	209.7	175	34.7	13	12
Roumania	1875–82	250.0	203	47.0	14	14
Austria	1866–83	255.3	223	32.3	15	15
Russia in Europe	1867–78	266.8	268	1.2*	16	16
Averages		174.9	159.1	15.8		

* Increase.

and on the face of the returns it would seem that those countries were to be congratulated on having somehow succeeded in devising ways and means of reducing this phase of the mortality problem in which the vast majority of countries have notably failed, whether through lack of serious attention to the subject or for other reasons. But is such the case? Let

us go behind the returns, locate the countries which have scored the largest apparent decreases, and consider for a moment whether those countries might naturally be expected to be found in the forefront of the movement for the reduction of infant mortality.

Of the sixteen countries named in the table, eight show an apparent annual decrease of more than 10 deaths per 1,000 births since the early 80's, the decrease ranging from 10.9 in the case of Norway up to the remarkable figure of 47 in the case of Roumania, and the other countries in the order of the largest seeming decrease being Switzerland, Italy, Austria, the Netherlands, Sweden, and Finland. And yet none of these countries has ever attained any particular prominence in the crusade for the protection of children's lives. Austria is the only one of the eight which could be even seriously considered as among the great European powers, and, as will be noted, none of the indisputably first-class powers appears in the list. In England, France, and Prussia the decrease in the death-rate was merely nominal, and, as the registration systems of those countries would probably be regarded as superior to that in any of the eight countries which have scored the apparent large decreases in the infant death-rate, it would seem not only possible, but extremely probable, that the decrease in the last-named countries was more apparent than real—in other words, was a decrease in figures only, very likely due to the material increase in the registration of births and the consequent decrease in the ratio of deaths under age 1 to births. In England, France, and Prussia the registration of births was probably much more complete thirty or forty years ago than in most of the smaller countries of Europe, and, if such was the case, there naturally would be much less fluctuation in the mortality rates in the case of those leading countries. Therein probably lies the explanation of most of the apparent large decreases in the last twenty-five years.

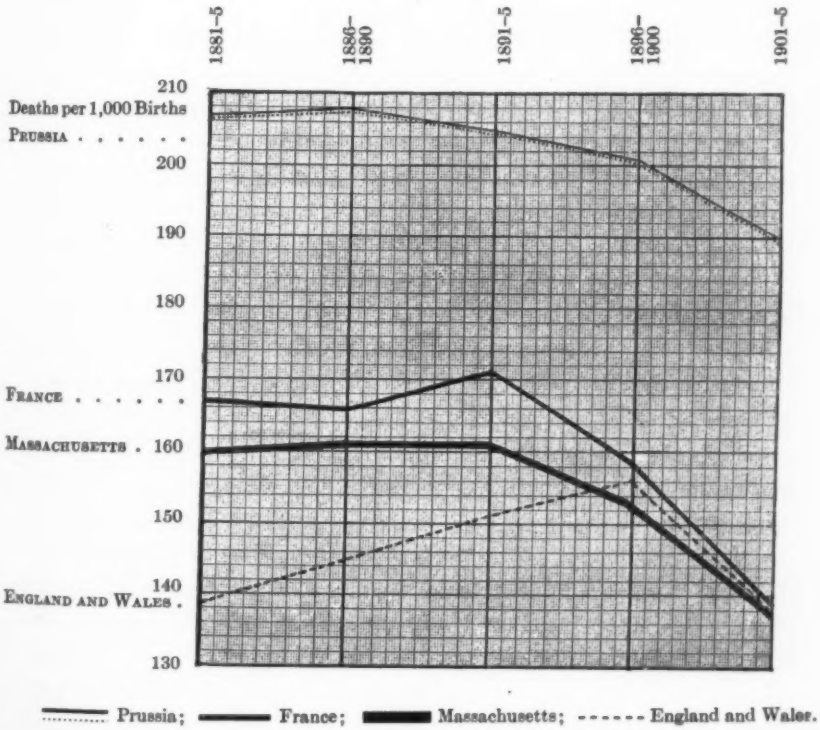
In default of positive evidence it would be absurd to believe that the little country of Roumania, with its limited resources, had succeeded in effecting a reduction of its infant death-rate

by nearly 20 per cent. in the last twenty-five years, and thereby materially distanced every other country in the world. Furthermore, as shown in Table III, the record of its infant death-rates by five-year periods proves that the rate has been almost continuously in the ascendant for that same period. The British Registrar-General's office was unable to obtain any infantile death-rates from Austria up to 1896, or from Italy up to 1891, and in those obtained since those dates there is no sign of any sharp decline. Norway, Sweden, Finland, the Netherlands, and Switzerland have apparently shown material decreases in the infant death-rate in most of the five-year periods of the last quarter of a century, but improved registration of births probably accounts for that fact in most, if not all, of those cases, and it would therefore seem that the pronounced differences in some cases between the death-rates of the old-time Bertillon table and the up-to-date table presented in connection with this study are unworthy of any serious attention. In the face of the surprising uniformity of the mortality rate in question in the world at large, and especially in countries having thoroughly established registration systems, only the most irrefutable evidence will convince any student of infant mortality of a *permanent* reduction in the infant death-rate in any country up to this time.

In so far as the infantile death-rate in the United States as a whole—either now or at any previous time—is concerned, there are absolutely no authentic data. In his contribution to the Eleventh Census Report on Vital and Social Statistics, published in 1896, Dr. Billings accounted for that fact by authoritatively stating (Part I, p. 21) that "we have no fully complete and accurate registration of births in any part of the United States. The most accurate registration is probably in Massachusetts, in which it is estimated that the deficiency is not greater than 2 per cent." Again, in Volume III of the Twelfth Census Reports (Vital Statistics, Part I, p. xlix) the late William A. King, Chief Statistician for Vital Statistics, commenced his discussion of births with the admission that "the data relating to births are the most incomplete and unsatis-

factory of any treated in this report. Were it not considered desirable to give such results as bear upon the question for the information of students of the statistics, the subject might be dismissed with the statement that they are entirely inadequate to determine, directly, the general birth-rate of the country, or, what is of equal practical importance, the relative birth-rate of different classes of population. A number of the States and cities have laws requiring the registration of births, but it is doubtful if there is a single place in which births are registered as fully as deaths."

DIAGRAM II.—THE INFANT MORTALITY RATES OF ENGLAND AND WALES, PRUSSIA, FRANCE, AND THE STATE OF MASSACHUSETTS BY FIVE-YEAR PERIODS FROM 1881 TO 1905, ON THE BASIS OF DEATHS UNDER 1 YEAR PER 1,000 BIRTHS, STILL-BIRTHS EXCLUDED.



As the census authorities have repeatedly stated, the data regarding the number of living children under 1 year of age are also utterly incomplete and inaccurate, owing to the fact that the number so returned is too small in practically all localities, partly owing to the practically universal tendency to report children in the later months of the first year as 1 year old. For these reasons it would be utterly futile to attempt the compilation of any figures of the infant mortality rate in the United States at large for purposes of comparison with the returns for other countries presented in the preceding tables. In the Registrar-General's annual reports for some years past, returns of this character from thirty-two countries have been presented, but the United States has been the one great country in the world for which no figures were given.

In the light of these conditions it might at first seem practically impossible to obtain even an approximate idea of the status of infant mortality in this country, but such is not the case, the number of registration States and the magnitude of their combined population being sufficient to afford a fairly accurate index of the conditions in Continental United States as a whole. The registration systems of these States greatly differ in point of comprehensiveness and reliability, but by common consent that of Massachusetts is regarded as of foremost importance, and the complete record of infant deaths in that State for the last half-century undoubtedly affords by far the best available standard of measurement and comparison in a study of infant mortality in this country. In the Twenty-eighth Annual Report of the State Board of Health of Massachusetts, published in 1897, there appeared a comprehensive study of "The Vital Statistics of Massachusetts—A Forty Years' Summary," which was prepared by Dr. Samuel W. Abbott, secretary of the Board of Health. This chapter of more than 100 pages (pp. 711–829) begins with a graphic tracing of the "Marriage, Birth, and Death Rates and Infantile Death-rate, Massachusetts, 40 Years, 1856-95," and contains a complete tabulation of "Infant Mortality, Massachusetts, 1856–95, Forty Years," presenting the annual figures for each of those years.

For some reason not explained in the text, the birth statistics in that tabulation begin with July 1, 1856, and end with June 30, 1895, whereas the deaths under 1 year in the same table are taken from the calendar-year records, thus making the birth and death rate figures materially differ from those in the twenty-year infant mortality record presented in recent Massachusetts registration reports of births, marriages, and deaths. It has seemed desirable to eliminate this discrepancy, and the following tabulation of infant mortality in Massachusetts for the fifty years ending Dec. 31, 1905, has therefore been compiled in part from Dr. Abbott's table of infant mortality (p. 750), in so far as deaths under 1 from 1856 to 1895, inclusive, are concerned, and partly from his tabulation of marriages, births, and deaths from 1842 to 1895 (pp. 721–722), the supplemental figures for births and infant deaths in the calendar years 1896 to 1905, inclusive, being taken from the twenty-year table of infant mortality in the current (sixty-fifth) Massachusetts Report of Births, Marriages, and Deaths (p. 205). The composite tabulation of infant mortality herewith presented is thus made complete for the fifty calendar years ending with 1905, and, in order to permit of comparison with the statistics of foreign countries presented in the previous tables accompanying this article, is supplemented with a column containing the annual birth-rates in Massachusetts for the last fifty calendar years, as presented in the Sixty-fifth Massachusetts Report of Births, Marriages, and Deaths (pp. 141–142). Still-births have been excluded in all cases.

TABLE VI.

A Complete Record of Births, Deaths under Age 1, the Infantile Death-rate per 1,000 Births, and the Birth-rate in Massachusetts for Each of the Fifty Years 1856–1905, Inclusive, excluding Still-births.

Calendar Year.	Births.	Deaths under 1 Year.		Birth-rate per 1,000 Population.
		Number.	Rate per 1,000 Births.	
1856	34,445	4,226	122.7	29.91
1857	35,320	4,160	117.8	30.17
1858	34,491	4,197	121.7	28.97
1859	35,422	4,175	117.9	29.28
1860	36,051	4,821	133.7	29.28
1861	35,445	5,167	145.8	28.63
1862	32,275	4,216	130.6	25.92
1863	30,314	4,545	149.9	24.20
1864	30,449	4,693	154.1	24.17
1865	30,249	4,869	161.0	23.87
1866	34,085	4,699	137.9	26.16
1867	35,062	4,763	135.8	26.17
1868	36,193	5,421	149.8	26.26
1869	36,141	5,368	148.5	25.50
1870	38,259	6,206	162.2	26.25
1871	39,791	5,996	150.7	26.63
1872	43,235	8,390	194.1	28.21
1873	44,481	7,911	177.8	28.31
1874	45,631	7,489	164.1	28.32
1875	43,996	7,712	175.3	26.63
1876	42,149	6,700	159.0	25.12
1877	41,850	6,343	151.5	24.57
1878	41,238	6,189	150.1	23.85
1879	40,295	5,855	145.3	22.95
1880	44,217	7,190	162.6	24.80
1881	45,220	7,389	163.4	24.93
1882	45,670	7,445	163.0	24.75
1883	47,285	7,515	158.9	25.14
1884	48,615	7,735	159.1	25.46
1885	48,790	7,625	156.3	25.12
1886	50,788	7,848	154.5	25.42
1887	53,174	8,514	160.1	25.86
1888	54,893	8,870	161.6	25.95
1889	57,075	9,105	159.5	26.23
1890	57,777	9,625	166.6	25.81
1891	63,004	10,186	161.7	27.53
1892	65,824	10,649	161.7	28.13
1893	67,192	10,990	163.6	28.09
1894	66,936	10,899	162.8	27.37
1895	67,545	10,564	156.4	27.02
1896	72,343	11,765	157.8	28.27
1897	73,205	10,751	146.9	27.96
1898	73,110	11,012	150.6	27.29
1899	70,457	10,532	149.5	25.70
1900	73,386	11,500	156.7	26.16
1901	71,976	9,952	138.3	25.07
1902	72,219	10,075	139.5	24.58
1903	73,584	10,269	138.3	24.48
1904	75,014	9,992	133.2	24.39
1905	75,022	10,519	140.2	24.98
Totals	2,511,188	382,627	152.4	26.32

Thanks to the early establishment of the registration system of Massachusetts, recognized the world over for many years as the most reliable index of American vital statistics, the preceding table unquestionably affords by far the most comprehensive and most authoritative tracing of infant mortality in at least one section of this country which is now obtainable from any or all sources. The pronounced annual fluctuations in both birth and death rates are somewhat misleading, however, and the appended tabulation of births and infant deaths by five-year periods not only puts the case much more comprehensibly, but also reduces the Massachusetts tabulation to the basis followed in the preceding foreign tabulations, and thus makes possible a comparison by five-year periods. Thus arranged, the statement of births and infant deaths in Massachusetts for the last half-century is as follows:—

TABLE VII.

BIRTHS, BIRTH-RATES PER 1,000 POPULATION, AND DEATHS UNDER 1 YEAR AND THEIR RATE PER 1,000 BIRTHS IN MASSACHUSETTS BY FIVE-YEAR PERIODS FOR THE FIFTY YEARS 1856–1905, INCLUSIVE—STILL-BIRTHS EXCLUDED IN BOTH CASES.

Five-Year Periods.	Living Births.		Deaths under 1 Year.	
	Number.	Birth-rate per 1,000 Population.	Number.	Rate per 1,000 Births.
1856–60	175,729	29.52	21,579	122.8
1861–65	158,732	25.36	23,490	148.0
1866–70	179,740	26.07	26,457	147.2
1871–75	217,134	27.62	37,498	172.7
1876–80	209,749	24.26	32,277	153.9
1881–85	235,580	25.09	37,709	160.1
1886–90	273,707	25.85	43,962	160.6
1891–95	330,501	27.63	53,288	161.2
1896–1900	362,501	27.08	55,560	153.3
1901–05	367,815	24.70	50,807	138.1
Totals	2,511,188	26.32	382,627	152.4

RECAPITULATION BY TWENTY-FIVE YEAR PERIODS.

1856–1880	941,084	26.57	141,301	150.1
1881–1905	1,570,104	26.07	241,326	153.7

When the summary for the last twenty-five years, in the last line of this table, is compared with the corresponding figures for foreign countries presented in Table III of this paper, one is immediately impressed with the surprising uniformity of the infant mortality rate the world around, which has already been alluded to. In the thirty-one foreign countries, in widely remote parts of the world, dealt with in Table III, the general average of deaths under 1 year to each 1,000 births in the twenty-five years ending with 1905 was 154: in the same period the infant death-rate in Massachusetts was 153.7. In the twenty European countries whose returns are presented in Table III—Austria, Hungary, and Russia, with their abnormally high death-rates, included—the average infant death-rate for the last twenty-five year period was 162 as compared with the Massachusetts rate of 153.7, and for the five five-year periods involved the European infant death-rates were, in order, 163, 162, 169, 162, and 153, as compared with death-rates of 160.1, 160.6, 161.2, 153.3, and 138.1 in Massachusetts. In fact, the correspondence between the infant death-rates of Europe and its leading countries and those of Massachusetts is so strikingly close that it can only be appreciated by means of a tabular statement, such, for instance, as the following:—

TABLE VIII.

A Comparison of the Infant Mortality Rates per 1,000 Births of the World at Large and Leading European Countries with those of Massachusetts by Five-year Periods, 1881–1905, Inclusive.

	1881 to 1885.	1886 to 1890.	1891 to 1895.	1896 to 1900.	1901 to 1905.	1881 to 1905.
31 foreign countries in all parts of the world . . .	155	152	159	157	147	154
20 European countries	163	162	169	162	153	162
England and Wales, France and Prussia	171	173	176	172	156	169
England and Wales, and France	153	156	161	158	139	153
Massachusetts	160	161	161	153	138	154

This table tells its own story, and would seem to prove beyond all peradventure that there is a general uniformity in the undulations of the infant mortality wave at various periods, in the world at large, however mysterious and inexplicable may be the undiscovered influences which regulate it. As will be observed, in all the different groups of countries above presented, there was a gradual rise in the death-rate up to 1891–95, and a gradual falling from 1895 to 1905, in each case the top notch being arrived at in 1891–5, and in every case except that of Massachusetts the death-rate for the entire twenty-five year period being practically identical with that of the first five-year period. The Massachusetts rate for the twenty-five years was lower by 6 deaths per 1,000 births than was the rate for the first five years, whereas in the case of all the other sections of the world named the largest decrease in the twenty-five year average as compared with the rate for the first five years was only 2 deaths per 1,000 births; and the comparison of the Massachusetts figures with those for England and Wales, France, and Prussia, is a particularly reliable one for the reason that the registration systems of those sections are presumably freer from error than any others which could be selected.

In short, this latest tabulation strongly confirms the broad average showings of Table III, and again suggests the question before raised—namely, why this surprising uniformity in the infant death-rate the world around? Furthermore, why the general rise in the death-rate from 1881 to 1895, and why the general fall in the death-rate from the last-named date down to 1905? No living man can rationally answer those grave questions. It would be pleasant to believe that, as the world advances in knowledge, in hygiene and sanitation, and in humanitarianism, infant mortality correspondingly decreases; but only a substantially continuous decline in the infant death-rate for a long term of years, in countries with thoroughly established registration systems, could substantiate any such optimistic theory.

As previously stated, the fifty-year record of Massachusetts affords the very best available standard of measurement and

DIAGRAM III.—THE AVERAGE INFANT MORTALITY RATES FOR THE TWENTY-FIVE YEARS, 1881-1905, OF SIXTEEN OF THE LEADING EUROPEAN COUNTRIES, AND THE STATE OF MASSACHUSETTS, ON THE BASIS OF DEATHS UNDER 1 YEAR PER 1,000 BIRTHS, STILL-BIRTHS EXCLUDED.

Deaths per 1,000 Births.
30
60
90
120
150
180
210
240
270
Norway . . . . . .
Ireland . . . . . .
Sweden . . . . . .
Scotland . . . . . .
Denmark . . . . . .
England and Wales . .
Switzerland . . . . .
Massachusetts . . . .
Belgium . . . . . .
France . . . . . .
The Netherlands . . .
Italy . . . . . .
Spain . . . . . .
Prussia . . . . . .
Austria . . . . . .
Hungary . . . . . .
Russia (in Europe) . . .

comparison for any study of infant mortality in this country, and *in comparison* with that standard the reports of recent decennial censuses of the United States, at best dealing with single twelvemonths ten years apart, are of but little value. In his interesting paper issued under the title of "A Discussion of the Vital Statistics of the Twelfth Census" by the Bureau of the Census in 1904 (Bulletin 15), Dr. Billings thus clearly explains this fact (pp. 7–8): "If the purpose in consulting these reports be to obtain comparative data showing the result of varying conditions upon the general mortality, or to show the relative death-rates at different ages, from different causes or of different classes of population in the same or different places during a series of consecutive years, the information must be sought from the local reports on this subject issued by the States or cities for which comparisons are wanted. Here the student or analyst finds great difficulty in securing any comprehensive information, owing to lack of tables covering the details sought. Very few of the cities make any extensive compilation of the material at their command, and in such compilations which are most complete, as well as in the State reports, there are differences in the forms of tables and in the methods of classifying the data which prevent carrying comparisons very far, even if they do not entirely preclude them. . . . No State has a complete registration of births, the ones that come nearest to it being probably Massachusetts, Rhode Island, and Connecticut, but the results of the registration in these States should be sought, not in the census report, but in the State reports of births, marriages, and deaths. The only States which had (at the time the Twelfth Census was taken) a registration of deaths sufficiently complete to make the death-rates worth calculating were Connecticut, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, and Rhode Island, which with the District of Columbia (and Vermont) form the group referred to in the census report as the 'registration' States."

Having secured by the courtesy of the registration officials of all the registration States copies of their recent reports, and

carefully studied them with a view to the compilation, if possible, of a general résumé of the infant death-rates in those States for a period of sufficient length to warrant at least certain general deductions, the writer is more than ready to agree with Dr. Billings that "in the State reports [of vital statistics] there are differences in the forms of tables and in the methods of classifying the data which prevent carrying comparisons very far, even if they do not entirely preclude them."

The Massachusetts report affords by far the best data for that purpose, containing a compact tabulation of infant mortality and the rate per 100 living births for each of the last twenty years. But no such thoroughly welcome data are to be found in any of the other registration States' current reports. The Connecticut report, which probably ranks second in general utility, has a ten-year table of mortality and death-rates by ages, but the death-rates for children under 1 year are the percentage ratios to total mortality. The New Jersey report's data and diagram dealing with infant mortality are made up on a basis of deaths under 5 years. The Rhode Island report states the annual infant death-rates to births for the last five years, but presents the rates for the previous fifty years in the abbreviated form of three ten-year and one twenty-year ratios. Most, if not all, of the other registration reports are even less serviceable in any extended compilation of infant mortality, in some cases still-births having been included in the figures up to very recent dates; and after a study of them all it became apparent that the United States census reports afford the only practicable means of securing within any reasonable time a comparative showing of the infant mortality in even the registration States for any considerable stretch of time, that is to say, with all the figures compiled and tabulated on a common basis. For reasons already stated an attempt to tabulate the returns from the country at large, including the non-registration States, would have been unworthy of serious consideration.

In the introductory remarks to his analysis of the vital sta-

tistics of the Twelfth Census, the late William A. King noted (vol. iii, p. xii) that "the census utilization of registration records as a source of information commenced with the Tenth Census (1880), when copies of the records of two States, Massachusetts and New Jersey, were secured and used as the basis of the statistics for those States. At the Eleventh Census (1890) the registration area was extended to include seven other States, namely: Connecticut, Rhode Island, New Hampshire, Vermont, New York, Delaware, and the District of Columbia, with the cities therein and 83 cities in other States." As stated in the introduction to the inaugural volume of the present annual mortality statistics, issued in 1906 by the Bureau of the Census (p. xiv), when the Twelfth Census was taken the registration area included all of the last-named States, and in addition the States of Maine and Michigan, and 153 cities of 8,000 or more population in other States.

The census utilization of registration records not having commenced until the taking of the Tenth Census, in 1880, any inquiry regarding infant mortality in this country as recorded in the census reports is obviously restricted to the Tenth Census for the earliest records of any value whatsoever, and the tables which have been prepared for this paper are therefore confined to the records of the Tenth, Eleventh, and Twelfth Censuses. Although Massachusetts and New Jersey were the only States whose registration records were used in the compilation of the Tenth Census, most, if not all, of the other registration States of 1900 had established bureaus of vital statistics as early as 1880. All of them except Maine and Michigan were included among the registration States when the Eleventh Census was taken, and, in order to make the comparison complete for the three latest censuses, the figures for both 1880 and 1890 of all the registration States of 1900 are included in the following tables. Prior to the Twelfth Census, still-births, which were then excluded, had been included in the United States census mortality figures, but in all of the tables here presented the still-births for all three census years have been eliminated.

carefully studied them with a view to the compilation, if possible, of a general résumé of the infant death-rates in those States for a period of sufficient length to warrant at least certain general deductions, the writer is more than ready to agree with Dr. Billings that "in the State reports [of vital statistics] there are differences in the forms of tables and in the methods of classifying the data which prevent carrying comparisons very far, even if they do not entirely preclude them."

The Massachusetts report affords by far the best data for that purpose, containing a compact tabulation of infant mortality and the rate per 100 living births for each of the last twenty years. But no such thoroughly welcome data are to be found in any of the other registration States' current reports. The Connecticut report, which probably ranks second in general utility, has a ten-year table of mortality and death-rates by ages, but the death-rates for children under 1 year are the percentage ratios to total mortality. The New Jersey report's data and diagram dealing with infant mortality are made up on a basis of deaths under 5 years. The Rhode Island report states the annual infant death-rates to births for the last five years, but presents the rates for the previous fifty years in the abbreviated form of three ten-year and one twenty-year ratios. Most, if not all, of the other registration reports are even less serviceable in any extended compilation of infant mortality, in some cases still-births having been included in the figures up to very recent dates; and after a study of them all it became apparent that the United States census reports afford the only practicable means of securing within any reasonable time a comparative showing of the infant mortality in even the registration States for any considerable stretch of time, that is to say, with all the figures compiled and tabulated on a common basis. For reasons already stated an attempt to tabulate the returns from the country at large, including the non-registration States, would have been unworthy of serious consideration.

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tistics of the Twelfth Census, the late William A. King noted (vol. iii, p. xii) that "the census utilization of registration records as a source of information commenced with the Tenth Census (1880), when copies of the records of two States, Massachusetts and New Jersey, were secured and used as the basis of the statistics for those States. At the Eleventh Census (1890) the registration area was extended to include seven other States, namely: Connecticut, Rhode Island, New Hampshire, Vermont, New York, Delaware, and the District of Columbia, with the cities therein and 83 cities in other States." As stated in the introduction to the inaugural volume of the present annual mortality statistics, issued in 1906 by the Bureau of the Census (p. xiv), when the Twelfth Census was taken the registration area included all of the last-named States, and in addition the States of Maine and Michigan, and 153 cities of 8,000 or more population in other States.

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In the second annual report of the Registrar-General's office, issued in 1840, in his discussion of the mortality of children, Dr. Farr laid down the rule (p. 16) that, "even though the registration of births is still deficient, yet, even with this admitted probable deficiency, the number of births, if applied as an element of calculation, will show a mortality much less than it appears in the Comparative Table of Deaths," and from that day to this that method of calculating the infant mortality rate has practically been regarded by all statistical authorities on the subject as freest from error, and hence the most reliable of all known methods of measuring the rate. By applying this standard of measurement the deaths under 1 year and rates per 1,000 births in 1880, 1890, and 1900 in the registration States of 1900, have been as shown in the appended table, according to the United States census reports for the years in question.

Many and serious as the defects in this table are—especially for the earliest year, 1880, when Massachusetts and New Jersey were the only registration States—it probably provides at

TABLE IX.

BIRTHS, DEATHS UNDER 1, AND DEATH-RATES PER 1,000 BIRTHS IN EACH OF THE REGISTRATION STATES OF 1900, ACCORDING TO THE TENTH, ELEVENTH, AND TWELFTH CENSUS REPORTS—STILL-BIRTHS EXCLUDED IN EACH CASE.

States.	Census Year 1900.			Census Year 1890.			Census Year 1880.		
	Births during Census Year.	Deaths under 1 Year of Age.	Deaths under 1 per 1,000 Births.	Births during Census Year.	Deaths under 1 Year of Age.	Deaths under 1 per 1,000 Births.	Births during Census Year.	Deaths under 1 Year of Age.	Deaths under 1 per 1,000 Births.
Registration States of 1900	418,321	60,524	144.7	329,823	53,645	162.6	297,490	36,036	121.1
Connecticut	21,757	3,101	142.5	15,864	2,344	147.8	13,825	1,387	100.3
District of Columbia	5,612	1,306	232.7	5,314	1,382	260.1	* 5,454	* 1,283	* 235.2
Maine	14,716	1,946	132.2	11,761	1,124	95.6	13,447	912	67.8
Massachusetts	67,228	10,754	160.0	48,156	8,792	182.6	41,338	5,891	142.5
Michigan	58,800	6,570	111.7	51,931	4,667	89.9	45,244	3,744	82.7
New Hampshire	8,872	1,384	156.0	6,918	1,063	153.7	6,557	589	89.8
New Jersey	48,158	7,292	151.4	36,351	6,939	190.9	31,069	4,296	138.3
New York	175,334	25,492	145.4	139,642	25,208	180.5	126,740	16,632	131.2
Rhode Island	10,472	1,854	177.0	7,732	1,490	192.7	6,603	711	107.7
Vermont	7,372	825	111.9	6,154	636	103.3	7,213	591	81.9

* Including still-births, no returns for still-births being given in reports of Tenth Census.

least an approximate idea of the relative death-rates among children under 1 year of age in the States in question in the census years 1880, 1890, and 1900. The District of Columbia has been included solely for the reason that it was part and parcel of the registration area in 1900, but its death-rate is not to be seriously considered, including as it does the heavy mortality among colored children, the colored infant death-rate being nearly twice as high as the white rate in each case. As the District of Columbia was the only portion of the registration area in 1900 having any considerable percentage of colored population, and as the comparatively unimportant colored mortality in the registration States is a negligible quantity so far as affecting the general mortality rates is concerned, it was not deemed advisable to attempt to separate the white and colored mortality in the preparation of the tables in this paper based upon the census reports. The District of Columbia figures are, therefore, of practically no importance in this analysis of the statistics of infant mortality, and may properly be disregarded in the study of any of the tables in which they appear. With them eliminated, it will be noted that in 1880 Massachusetts apparently led all the States named in its apparent infant death-rate of 142.5, but that Rhode Island took the lead in 1890 and retained it in 1900. According to the census reports, Massachusetts' infant death-rates in the census years 1880, 1890, and 1900, were respectively 142.5, 182.6, and 160.0 as compared with rates of 162.6, 166.6, and 156.7 for the calendar years in question, according to the registration records of the State as presented in Table VI.

The above table undoubtedly presents the most accurate showing of infant mortality in the districts dealt with which can be compiled from the census reports for the years in question, but, in order to perfect the statistical record of the subject, it may be worth while to find space for the infant death-rates in the several States named, as measured, (1) by the rate of deaths under 1 year per 1,000 of the supposed living population of that age, and (2) by the ratio of infant deaths to total deaths. The census figures in both cases are presented in Tables X and XI herewith appended:—

TABLE X.

THE INFANT MORTALITY RATE IN 1880, 1890, AND 1900 IN EACH OF THE REGISTRATION STATES OF 1900, AS MEASURED BY THE RATE OF DEATHS UNDER 1 YEAR PER 1,000 LIVING POPULATION OF THAT AGE ACCORDING TO THE TENTH, ELEVENTH, AND TWELFTH CENSUS REPORT—STILL-BIRTHS EXCLUDED.

States.	Census Year 1900.			Census Year 1890.			Census Year 1880.		
	Population at End of Census Year.	Deaths.	Death-rate per 1,000 Living.	Population at End of Census Year.	Deaths.	Death-rate per 1,000 Living.	Population at End of Census Year.	Deaths.	Death-rate per 1,000 Living.
Registration States of 1900	379,951	60,524	159.3	298,154	53,645	179.9	273,559	36,036	131.7
Connecticut	19,774	3,101	156.8	14,469	2,344	162.0	12,879	1,387	107.7
District of Columbia .	4,758	1,306	274.5	4,467	1,382	309.4	4,624	*1,283	*277.5
Maine	13,503	1,946	144.1	11,158	1,124	100.7	12,812	912	71.2
Massachusetts	60,492	10,754	177.8	43,043	8,792	204.3	37,587	5,891	156.7
Michigan	54,161	6,570	121.3	48,954	4,667	95.3	42,585	3,744	87.9
New Hampshire . . .	8,048	1,384	172.0	6,347	1,063	167.5	6,141	589	95.9
New Jersey	43,571	7,292	167.3	32,087	6,939	216.2	28,192	4,296	152.4
New York	159,521	25,492	159.8	124,977	25,208	201.7	115,847	16,632	143.6
Rhode Island	9,368	1,854	197.9	6,890	1,490	216.3	6,132	711	115.9
Vermont	6,755	825	122.1	5,762	636	110.4	6,760	591	87.4

* Including still-births, no returns for still-births being given in reports of Tenth Census.

TABLE XI.

THE INFANT MORTALITY RATE IN 1880, 1890, AND 1900 IN EACH OF THE REGISTRATION STATES OF 1900, AS MEASURED BY THE RATE OF DEATHS UNDER 1 YEAR PER 1,000 DEATHS AT ALL AGES, ACCORDING TO THE TENTH, ELEVENTH, AND TWELFTH CENSUS REPORTS—STILL-BIRTHS EXCLUDED.

States.	Census Year 1900.			Census Year 1890.			Census Year 1880.		
	Total Deaths during Census Year.	Deaths under Age 1 during Census Year.		Total Deaths during Census Year.	Deaths under Age 1 during Census Year.		Total Deaths during Census Year.	Deaths under Age 1 during Census Year.	
		Deaths.	Rate per 1,000 at All Ages.		Deaths.	Rate per 1,000 at All Ages.		Deaths.	Rate per 1,000 at All Ages.
Registration States of 1900	301,670	60,524	200.6	262,149	53,645	204.6	191,230	36,036	188.4
Connecticut	15,422	3,101	201.1	13,863	2,344	169.1	8,977	1,387	154.5
District of Columbia .	6,364	1,306	205.2	5,449	1,382	253.6	*4,192	*1,283	*306.1
Maine	12,148	1,946	160.2	9,974	1,124	112.7	9,384	912	97.2
Massachusetts	49,756	10,754	216.1	43,102	8,792	204.0	31,752	5,891	185.5
Michigan	33,572	6,570	195.7	24,118	4,667	193.5	19,144	3,744	195.6
New Hampshire . . .	7,400	1,384	187.0	6,856	1,063	155.0	5,503	589	107.0
New Jersey	32,735	7,292	222.7	28,455	6,939	243.8	18,434	4,296	233.0
New York	130,268	25,492	195.7	117,837	25,208	213.9	84,450	16,632	196.9
Rhode Island	8,176	1,854	226.8	7,234	1,490	206.0	4,507	711	157.7
Vermont	5,829	825	141.5	5,261	636	120.9	4,887	591	120.9

* Including still-births, no returns for still-births being given in reports of Tenth Census.

Were the tabulation of the census records of the infant death-rate per 1,000 of living population under 1 year at the end of each census year unaccompanied by tables based on other standards of measuring infant mortality, affording ready means of checking the various figures and thus measuring the probable margin of error, it would be comparatively valueless. For, as previously stated, the census authorities have often admitted that the data regarding the number of living children under 1 year of age are utterly incomplete and inaccurate. As Dr. Farr put it in discussing the mortality of infants (Supplement to 25th Annual Report of the Registrar-General, pp. v–vi), "The infants in the first year of life are to some extent mixed up with infants in the second year of age." And, as Dr. Billings explained in his remarks regarding infantile mortality published in the Report on Vital and Social Statistics in the United States at the Eleventh Census (Part I, p. 21): "Unfortunately, these data are incomplete and inaccurate, not only for the United States as a whole, but for all parts of the registration area. This is due to the fact that the number of children returned as being under 1 year of age is too small in every locality, owing partly to omissions in the enumeration, and partly to the tendency of those reporting the age of infants to report those who are between 9 and 12 months of age as being, in round numbers, 1 year old, which last is a defect common to the censuses of all countries."

The apparent living population under 1 year of age for these reasons being much understated in the returns, of course the alleged rates of deaths under 1 to the living population at that age are almost invariably in excess of the actual rates on that basis: hence the table worked out on those lines would be of little value by itself. The tabulation of rates of infant deaths per 1,000 deaths at all ages probably is open to less objection, but that table, too, is open to much more intelligent interpretation when supplemented with tables prepared on other bases of measurement, and especially with one laid out on the generally accepted plan of death-rates to births. But for the presence of the last-named table, it would not have been considered

worth while to present in this article the two other tables above mentioned.

The death-rate of persons *over* 1 year of age is a natural complement to the death-rate of infants under 1 year, if both are prepared on a common basis, and materially aids in determining whether a high infant mortality is presumably, in part at least, due to unsanitary conditions or to independent causes. In none of the works on the subject of infantile mortality which the writer has examined does such a tabulation appear, and by way of adding at least some information to the statistical records of the subject the following table has been prepared, on the basis of the census reports for 1880, 1890, and 1900:—

TABLE XII.

DEATHS *over* 1 YEAR OF AGE AND RATE PER 1,000 POPULATION OVER 1 YEAR IN 1880, 1890, AND 1900 IN THE REGISTRATION STATES OF 1900, ACCORDING TO THE TENTH, ELEVENTH, AND TWELFTH CENSUS REPORTS.

States.	Census Year 1900.			Census Year 1890.			Census Year 1880.		
	Population over 1 Year of Age at End of Census Year.	Deaths at over 1 Year of Age during Census Year.	Death-rate per 1,000 of that Age.	Population over 1 Year of Age at End of Census Year.	Deaths at over 1 Year of Age during Census Year.	Death-rate per 1,000 of that Age.	Population over 1 Year of Age at End of Census Year.	Deaths at over 1 Year of Age during Census Year.	Death-rate per 1,000 of that Age.
Registration States of 1900	17,064,329	241,146	14.1	14,169,658	208,504	14.7	11,765,518	155,194	13.2
Connecticut . . .	888,646	12,321	13.9	731,789	11,519	15.7	609,821	7,590	12.4
District of Columbia,	273,960	5,058	18.5	225,925	4,067	18.0	173,000	2,909	16.8
Maine	680,963	10,202	15.0	649,928	8,850	13.6	636,124	8,472	13.3
Massachusetts . .	2,744,854	39,002	14.2	2,195,900	34,310	15.6	1,745,498	25,861	14.8
Michigan	2,366,821	27,002	11.4	2,044,935	19,451	9.5	1,594,352	15,400	9.7
New Hampshire .	403,540	6,016	14.9	370,183	5,793	15.6	340,850	4,914	14.4
New Jersey	1,840,098	25,443	13.8	1,412,846	21,516	15.2	1,102,924	14,138	12.8
New York	7,109,373	104,776	14.7	5,872,876	92,629	15.8	4,967,024	67,818	13.7
Rhode Island . . .	419,188	6,322	15.1	338,616	5,744	17.0	270,399	3,796	14.0
Vermont	336,886	5,004	14.9	326,660	4,625	14.2	325,526	4,296	13.2

In so far as the mortality reports of the Tenth, Eleventh, and Twelfth Censuses contribute any really material data to the records of infant mortality in the last three census years in the States recognized as registration States in 1900, the preceding table practically rounds out the information therein obtainable, and it might now seem to be in order to make a comparison of the infant death-rates in the several registration States as measured by the standards of the various tables which have been presented. By so doing, at least an approximate idea of the actual relative rank of the States in question in point of their respective infant death-rates may be obtained, and, possibly, some information of working value be contributed to the rapidly growing bibliography of the subject. Perhaps the shortest and most effective means of reaching this end will be that of assembling at close contact the infant death-rates of each State according to the various standards of calculation employed in the preceding tables, and attaching in each case the numeral showing the relative rank of the State in question from that point of view. In compact form here are the results of an inquiry shaped on those lines, eliminating the District of Columbia for reasons previously explained:—

TABLE XIII.

A Comparison of the Infant Mortality Rates—and Their Complement, the Death-rate at All Ages *over* 1 Year—in 1900, 1890, and 1880 in the Registration States of 1900, and the Relative Rank of Each of the Nine States in the Order of Those Death-rates.

States.	Death-rate under 1 Year per 1,000 Births.						Death-rate under 1 Year per 1,000 of that Age living at End of Census Year.					
	1900.		1890.		1880.		1900.		1890.		1880.	
	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.
Connecticut . . .	142.5	6	147.8	6	100.3	5	156.8	6	162.0	6	107.7	5
Maine	132.2	7	95.6	8	67.8	9	144.1	7	100.7	8	71.2	9
Massachusetts . .	160.0	2	182.6	3	142.5	1	177.8	2	204.3	3	156.7	1
Michigan	111.7	9	89.9	9	82.7	7	121.3	9	95.3	9	87.9	7
New Hampshire .	156.0	3	153.7	5	89.8	6	172.0	3	167.5	5	95.9	6
New Jersey . . .	151.4	4	190.9	2	138.3	2	167.3	4	216.2	2	152.4	2
New York	145.4	5	180.5	4	131.2	3	159.8	5	201.7	4	143.6	3
Rhode Island . .	177.0	1	192.7	1	107.7	4	197.9	1	216.3	1	115.9	4
Vermont	111.9	8	103.3	7	81.9	8	122.1	8	110.4	7	87.4	8

TABLE XIII.—*Continued.*

States.	Death-rate under 1 Year per 1,000 Deaths at All Ages.						Death-rate for All Ages over 1 Year per 1,000 of Those Ages Living at End of Census Year.					
	1900.		1890.		1880.		1900.		1890.		1880.	
	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.	Rate.	Rank.
Connecticut . . .	201.1	4	169.1	6	154.5	6	13.9	7	15.7	3	12.4	8
Maine	160.2	8	112.7	9	97.2	9	15.0	2	13.6	8	13.3	5
Massachusetts . .	216.1	3	204.0	4	185.5	4	14.2	6	15.6	4—	14.8	1
Michigan	195.7	5—	193.5	5	195.6	3	11.4	9	9.5	9	9.7	9
New Hampshire .	187.0	7	155.0	7	107.0	8	14.9	3—	15.6	4—	14.4	2
New Jersey . . .	222.7	2	243.8	1	233.0	1	13.8	8	15.2	6	12.8	7
New York . . .	195.7	5—	213.9	2	196.9	2	14.7	5	15.8	2	13.7	4
Rhode Island . .	226.8	1	206.0	3	157.7	5	15.1	1	17.0	1	14.0	3
Vermont	141.5	9	120.9	8	120.9	7	14.9	3—	14.2	7	13.2	6

A somewhat noticeable feature of this tabulation of comparisons is the fact that, materially differing though the infant death-rates of any particular State do in any one census year as measured by the ratios to births and to living population at the age of 1 at the end of the census year, in every case the relative rank of the State as determined by the two standards remains the same in all three census years. For instance, Massachusetts ranked first in 1880, third in 1890, and second in 1900 in point of both death-rates to births and to living population under age 1 at the end of the census year; New Jersey ranked second in both 1880 and 1890, and fourth in 1900, by both measurements, and so on. In a general way, it might be expected that there probably would be no radical shift in the ranking of the States from census to census in point of either the number of births or the population under age 1 at the end of the census years, but the coincidence of each State's ranking remaining the same in any census year, whether measured by the rate of infant deaths to births or to surviving infants under age 1 at the end of the census year, is at least passing strange, taking into account the habitual and historic inaccuracy in the reporting of living infants under age 1.

Of course, if the infant migration and emigration in a census

year were disregarded, if the infant deaths during the census year were restricted to babies born during the year, and if census returns were complete and absolutely accurate, the number living under age 1 at the end of the year would be the exact complement of the number dying during the year. But the infant migration and emigration cannot be disregarded. A minor but considerable percentage of the infant deaths in any year are those of babies born in the later months of the previous year; and the returns for births, deaths, and living population by ages—especially for population under age 1—are, and always have been, notoriously incomplete and inaccurate. Hence the absolute uniformity of the ranking of each State in the last three censuses, whether measured by its infant mortality rate to births or to living population under age 1, is at least worthy of note.

Unfortunately, the figures of most of the registration States, so far as the infant death-rate to births is concerned, have been open to the suspicion of too glaring inaccuracies—at least up to a very recent period—to warrant any attempt to make comparison between them and those of the European countries with long-established registration systems. But the census returns for these States in 1880, 1890, and 1900, herewith presented for what they are worth, are none the less worthy of a careful study from various view-points by those interested in the subject of infant mortality.

In this paper the writer has aimed to supplement the work of the numerous medical experts, who have long been probing the puzzling problems of infant mortality, by bringing together from various sources and presenting in compact form the most reliable statistical information now obtainable which would warrant some definite conclusions as to the rise or fall of the infant mortality rate in recent years throughout the world, and the apparent present tendencies of the infant death-rate. It has seemed possible that the presentation of specific information on these lines might provide sound foundations, in the way of authoritative facts and figures of international scope, for the widely extended movement now being earnestly

made for the reduction of the infant death-rate. If so, the purpose of this paper will have been served, and possibly in a later paper the writer may present some of the mass of data as to the fundamental causes for the abnormally heavy infant mortality in certain sections—and especially in certain factory towns—which have accumulated in his hands, but have been foreign to the purposes of this preliminary and purely statistical study of the far-reaching subject which is just beginning in these twentieth-century days to make its real importance felt. In the consideration of it, and of the almost innumerable problems involved in it, not only the prospective population, but the general welfare, of the entire civilized world are deeply concerned. As Dr. Alden has so gravely remarked, "A thorough understanding of the subject should be the concern of every true citizen."

THE STATISTICAL STUDY OF CAUSES OF DESTITUTION.

By Gustav Kleene, Professor of Economics, Trinity College.

In regard to the causes of poverty, and of the degree of poverty that may be designated as destitution and leads to dependency, there are found in the literature of the social sciences a few formal discussions, but more frequently only remarks made in passing, or more or less obvious implications. The usual manner of treatment is descriptive rather than analytic, and is confined to particular causes and conditions. Professor Warner, one of the few writers who have aimed at a comprehensive treatment of the subject, points out that three tolerably distinct methods of investigation have been tried. First, there is the method of writers like Malthus, Marx, and Henry George, "who from the well-known facts of social organization have sought to deduce the causes tending to poverty." Secondly, there is the study of "the classes not yet pauperized to determine by induction what forces are tending to crowd individuals downward across the pauper line. . . . The best example of such work is probably that of Mr. Charles Booth in his 'Labor and Life of the People.' Almost all of the reports of our labor statisticians, the works on occupational mortality and morbidity, and in fact everything of a descriptive nature that has been written about modern industrial society, can be used in this second method of seeking for the causes of poverty." Thirdly, there is the "inductive study of concrete masses of pauperism, usually separating the mass into its individual units, seeking to ascertain in a large number of particular cases what causes have operated to bring about destitution."

* *American Charities*, pp. 22–117. See also articles by Professor Warner in Volumes I and IV of the Publications of the American Statistical Association.

It is proposed in the following to examine the third method only. This method, that of *case-counting*, has been applied by Warner to the records of American charity organization societies and by Charles Booth to English paupers. The National Conference of Charities some years ago appointed a committee to prepare a statistical blank for the use of charity organization societies in collecting data for studies of this kind. Mr. Booth sought for each case the "principal or obvious" and one "contributing" cause, and has tabulated his data so as to show the number of cases of pauperism attributable to each cause as principal, and also the number of cases attributable to each combination of principal and contributory cause. The following is taken from his tabulation of almshouse paupers at Stepney:—

Principal or Obvious Cause.	Total.	Per Cent.	Contributory Causes.			
			Drink.	Pauper Association and Heredity.	Sickness.	Old Age.
1. Drink	80	12.6	—	23	11	11
2. Immorality	16	2.5	3	3	3	1
3. Laziness	12	1.9	6	5	1	3
4. Incapacity, temper, etc.	24	3.8	4	5	2	6
5. Extravagance	8	1.3	4	2	—	3
6. Lack of work or trade misfortune	28	4.4	4	—	5	13
7. Accident	30	4.7	4	2	1	14
8. Death of husband	26	4.1	3	2	10	8
9. Desertion	3	.5	3	—	1	1
10. Mental derangement	11	1.7	1	2	—	2
11. Sickness	169	26.7	24	38	5	41
12. Old age	208	32.8	22	18	44	—
13. Pauper association and heredity	7	1.1	1	—	2	2
14. Other causes	12	1.9	6	6	2	2

Professor Warner gives only the number and percentage of cases attributable to each cause as principal (see Table IV, *American Charities*). He admits that this is unsatisfactory because there are few cases in which destitution has resulted from a single cause, and for many cases "to pick out one cause and call it the most important is a purely arbitrary proceeding." He proposed at one of the meetings of the Na-

TABLE IV. (A. G. WARNER

CAUSES OF POVERTY AS DETERM

Report from	Agency or Person Responsible for the Report.	Year or Years.	Causes indicating Misconduct.														Lack of Normal Support.								Matters o			
			Drink.		Immorality.		Laziness.		Shiftlessness and Inefficiency.*		Crime and Dishonesty.		Roving Disposition.†		Total.		Imprisonment of Breadwinner.		Orphans and Abandoned Children.		Neglect by Relatives.		No Male Support.‡		Lack of Employment.§		Insufficient Employment.	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	
BALTIMORE.	Charity Organization Society.	1890–91	62	9.0	–	–	–	–	97	14.0	5	.7	9	1.4	173	25.1	–	–	2	.4	14	2.0	28	4.0	90	13.0	55	
		1891–92	49	7.1	–	–	–	–	83	12.0	7	1.0	10	1.4	149	21.5	3	.4	10	1.4	10	1.4	35	5.0	83	12.0	63	
BOSTON.	Associated Charities.	1890–91	190	19.2	–	–	–	–	75½	7.6	14½	1.5	6	.6	286	28.9	16½	1.6	5	.5	8	.8	71	7.2	139½	14.1	59½	
		1891–92	239	21.9	–	–	–	–	75½	6.9	15	1.4	12	1.1	341½	31.4	19	1.7	12	1.0	12	1.0	52	4.8	156	14.3	55½	
BUFFALO.	Charity Organization Society.	1878–87	700	11.6	–	–	–	–	440	7.3	–	–	–	–	1140	18.9	108	1.8	–	–	–	–	397	6.6	1873	31.1	–	
		1888–89	44	8.9	–	–	–	–	18	3.6	–	–	–	–	62	12.5	11	2.2	–	–	–	–	74	14.9	135	27.2	–	
		1889–90	28	4.9	–	–	–	–	33	5.7	–	–	–	–	61	10.6	14	2.4	–	–	–	–	77	13.4	187	32.5	–	
		1890–91	32	5.7	–	–	–	–	10	1.8	–	–	–	–	42	7.5	10	1.9	–	–	–	–	109	19.4	150	26.8	–	
		1891–92	47	8.1	–	–	–	–	20	3.4	2	.3	1	.2	70	12.0	11	1.9	–	–	–	–	87	15.0	127½	21.9	33	
CINCINNATI.	Associated Charities.	1890–91	288	13.3	–	–	–	–	290	13.3	15	.7	113	5.2	706	32.5	6	.3	11	.5	23	1.1	155	7.1	211	9.7	54	
		1891–92	246	9.2	–	–	–	–	334	12.5	80	3.0	145	5.4	805	30.1	32	1.2	44	1.6	13	.5	190	7.1	302	11.3	317	
NEW YORK CITY.	Charity Organization Society.	1891	151	10.7	–	–	–	–	102	7.2	20	1.4	46	3.3	319	22.6	8	.6	2	.1	7	.5	102	7.2	409	29.0	86	
STEPNEY.	Charles Booth.	—	80	12.6	16	2.5	12	1.9	32	5.1	–	–	–	–	140	22.1	–	–	–	–	–	–	29	4.6	28	4.4	–	
ST. PANCRAS.	Charles Booth.	—	161	21.9	51	6.9	78	10.6	21	2.8	–	–	–	–	311	42.2	–	–	–	–	–	–	21	2.8	16	2.2	–	
76 GERMAN CITIES.	Böhmert.	—	1262	1.3	–	–	–	–	–	–	–	–	1300	1.4	2562	2.7	1619	1.7	5337	5.6	610	.6	2427	2.5	11,991	12.5	–	

* Includes Mr. Booth's headings, "Extravagance" and "Incapacity," "Temper," etc. An examination of the cases classed by Mr. Booth under the latter heading shows that it is more properly placed as above than it would be elsewhere.

† Includes from German tables "Laziness and Shift

‡ Includes "Death of Husband" and "Desertion."

§ Includes, for the English tables, "Trade Misfortune

TABLE IV. (A. G. WARNER, *Am*

CAUSES OF POVERTY AS DETERMINED

					Lack of Normal Support.								Matters of Emp				
	Roving Disposition.†		Total.		Imprisonment of Breadwinner.		Orphans and Abandoned Children.		Neglect by Relatives.		No Male Support.‡		Lack of Employment.§		Insufficient Employment.		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
	9	1.4	173	25.1	–	–	2	.4	14	2.0	28	4.0	90	13.0	55	8.0	
	0	1.4	149	21.5	3	.4	10	1.4	10	1.4	35	5.0	83	12.0	63	9.1	
	6	.6	286	28.9	16½	1.6	5	.5	8	.8	71	7.2	139½	14.1	59½	6.0	
	2	1.1	341½	31.4	19	1.7	12	1.0	12	1.0	52	4.8	156	14.3	55½	5.0	
	–	–	1140	18.9	108	1.8	–	–	–	–	397	6.6	1873	31.1	–	–	4
	–	–	62	12.5	11	2.2	–	–	–	–	74	14.9	135	27.2	–	–	
	–	–	61	10.6	14	2.4	–	–	–	–	77	13.4	187	32.5	–	–	
	–	–	42	7.5	10	1.9	–	–	–	–	109	19.4	150	26.8	–	–	
	1	.2	70	12.0	11	1.9	–	–	–	–	87	15.0	127½	21.9	33	5.7	
	13	5.2	706	32.5	6	.3	11	.5	23	1.1	155	7.1	211	9.7	54	2.5	
	45	5.4	805	30.1	32	1.2	44	1.6	13	.5	190	7.1	302	11.3	317	11.9	2
	46	3.3	319	22.6	8	.6	2	.1	7	.5	102	7.2	409	29.0	86	6.1	
	–	–	140	22.1	–	–	–	–	–	–	29	4.6	28	4.4	–	–	
	–	–	311	42.2	–	–	–	–	–	–	21	2.8	16	2.2	–	–	
	00	1.4	2562	2.7	1619	1.7	5337	5.6	610	.6	2427	2.5	11,991	12.5	–	–	

mper," etc.
rs that it is

† Includes from German tables "Laziness and Shiftlessn
‡ Includes "Death of Husband" and "Desertion."
§ Includes, for the English tables, "Trade Misfortune."

Causes Indicating Misfortune.																															
tters of Employment.						Matters of Personal Capacity.														Not Classified.											
Insufficient Employment.		Poorly Paid Employment.		Unhealthy or Dangerous Employment.		Ignorance of English.		Accident.		Sickness or Death in Family.		Physical Defect.		Insanity.‖		Old Age.		Total.		Large Family.¶		Nature of Abode.		Pauper Associates and Heredity.		Other or Unknown.		Total.		Total.
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
55	8.0	41	6.0	3	.4	2	.4	28	4.0	134	19.5	35	5.0	4	.6	35	5.0	471	68.3	31	4.5	5	.7	–	–	10	1.5	46	6.7	690
63	9.1	28	4.0	2	.3	–	–	28	4.0	146	21.0	49	7.1	7	1.0	49	7.1	513	73.8	14	2.0	3	.4	–	–	16	2.3	33	4.7	695
59½	6.0	5	.5	6	.7	6½	.7	35½	3.6	229½	23.2	24½	2.5	7	.7	38	3.8	651	65.7	5½	.6	3	.3	–	–	45½	4.5	54	5.4	991
55½	5.0	14	1.3	1	.1	10	.9	25	2.3	271½	24.9	25	2.3	7	.6	47	4.4	707	64.7	4	.4	–	–	–	–	39	3.5	43	3.9	1092
–	–	451	7.5	–	–	–	–	208	3.5	1268	21.1	525	8.7	51	.8	–	–	4881	81.1	–	–	–	–	–	–	–	–	–	–	6021
–	–	43	8.7	–	–	–	–	23	4.6	113	22.7	33	6.6	3	.6	–	–	435	87.5	–	–	–	–	–	–	–	–	–	–	497
–	–	38	6.6	–	–	–	–	29	5.0	137	23.8	30	5.2	3	.5	–	–	515	89.4	–	–	–	–	–	–	–	–	–	–	576
–	–	39	7.0	–	–	–	–	31	5.5	147	26.2	28	5.0	4	.7	–	–	518	92.5	–	–	–	–	–	–	–	–	–	–	560
33	5.7	2	.3	–	–	1	.2	26	4.5	171½	29.5	6	1.0	10	1.8	21	3.6	496	85.4	1	.2	13	2.2	–	–	1	.2	15	2.6	581
54	2.5	19	.9	4	.2	23	1.1	49	2.3	337	15.5	38	1.7	13	.6	66	3.0	1009	46.4	69	3.2	35	1.6	–	–	335	16.3	459	21.1	2174
317	11.9	200	7.5	21	.8	16	.6	62	2.3	389	14.6	86	3.2	19	.7	83	3.1	1774	66.4	84	3.1	7	.3	–	–	–	–	91	3.4	2670
86	6.1	35	2.5	–	–	5	.4	47	3.3	261	18.5	39	2.7	10	.7	47	3.3	1058	74.9	8	.6	7	.5	–	–	20	1.4	35	2.5	1412
–	–	–	–	–	–	–	–	30	4.7	169	26.7	–	–	11	1.7	208	32.8	475	74.9	–	–	–	–	7	1.1	12	1.9	19	3.0	634
–	–	–	–	–	–	–	–	19	2.6	152	20.7	–	–	32	4.3	172	23.4	412	56.0	–	–	–	–	13	1.8	–	–	13	1.8	736
–	–	–	–	–	–	–	–	1100	1.1	43,747	45.8	2325	2.4	3406	3.4	15,086	15.8	87,648	91.4	4774	5.0	–	–	–	–	861	.9	5635	5.9	95,845

d Shiftlessness," "Arbeitsscheu."
tion."
sfortune." For German table, "Small Earnings."

‖ Includes "Mental Derangement."

¶ Includes from German tables "Grosse Kinderzahl," "Vorhandensein mehrerer Kinder."

tional Conference of Charities "to consider the influences resulting in destitution in each case as making up ten units, and indicate the relative force of each cause by a proportionate number of units." The method was rejected as too complicated, but has been used by Mr. A. M. Simons in a study of cases treated by the Chicago Bureau of Associated Charities.* The tabulated results are as follows:—

	Stock Yards District.	Englewood.
Lack of employment	456	499
Intemperance	157	105
Sickness	154	95
Incompetence	61	36
Desertion of breadwinner	51	22
Laziness	34	160
Old age	33	54
Death of breadwinner	33	29
Pauper association	17	0
Insanity	4	0

In Professor Lindsay's report to the National Conference† the method employed by Warner is used. A condensed statement is here given:‡—

A. Causes indicating misconduct:

Drink, 5–23; immorality, none; shiftlessness and inefficiency, 4.93–14; crime and dishonesty, 0–1.5; roving disposition, 0–3.26.

B. Causes indicating misfortune:

a. Lack of normal support.

Imprisonment of breadwinner, 0–2; orphans and abandoned children, 0–1.5; neglect by relatives, 0–2.3; no male support, 3.6–7.22.

* *American Journal of Sociology*, vol. iii.

† Report National Conference of Charities, 1899, p. 369.

‡ The numbers in this statement are percentages of cases. The range from the lowest percentage in any city for one year to the highest is given. Thus the lowest percentage assigned to drink is five for the year 1894–95 in Baltimore, the highest is twenty-three per centum for the year 1889–90, and also for 1892–93 in Boston. The cities studied are: New York, 1889–98; Boston, 1889–93; and Baltimore, 1889–95.

b. Matters of employment.

Lack of employment, 12–37.67; insufficient employment, 0–14.47; poorly paid employment, 0–10.5; unhealthy and dangerous employment, 0–.6.

c. Matters of personal capacity.

Ignorance of English, 0–1; accident, 1.2–5; sickness or death in family, 13.75–26.50; physical defects, 1.28–7; insanity, .25–1; old age, 0–7.

C. Not classified:

Large family, 0–4.5; nature of abode, 0–1; other or unknown, .35–10.

What can be said of the scientific value of these studies? The case-counting method, dealing as it does with actual cases, with the "facts," seems at first sight to offer the most direct line of approach to the problem. Its statistical appearance arouses the hope that the effect of various causes may be measured and the importance of causes disclosed by quantitative comparison. Upon the important causes ameliorative efforts could then be concentrated, and the practical value of this method of study be demonstrated. Closer examination, however, will show that suggestive as the study of concrete cases of destitution may be, nothing is gained by the application of statistical methods. In other words, the relative weight of causes of poverty cannot be established by counting cases.

In the first place the data used are cases of dependency, not of destitution. Agencies of relief are not yet so discriminating as to exclude from assistance all who are not destitute and none who are. The number of dependents therefore does not coincide with the number of the destitute. Assuming, however, that the correspondence between these two classes is sufficient to permit inferences drawn from the study of one to be applied, without qualification, to the other, we are confronted with a more serious difficulty. Mere number of cases attributable to a given cause is not an accurate index of its effect. A hundred slight cases obviously cannot be regarded as the equivalent of a hundred serious ones. It will be neces-

sary, therefore, to ascertain the degree or amount of destitution in each case due to a given cause, if the total effect of this cause is to be summed up in such manner as to make possible comparison with other causes. Comparison of the effect of different factors would be a simple matter if (1) each case were due to only one cause and (2) there were some method by which degree of destitution could be measured. Usually there are many causes for each case. The method suggested by Professor Warner and employed by Mr. Simons of assigning ten units to each case and indicating the relative force of each of the causes at work by its proportionate share of these ten units would be only a very rough index of the proportion of the destitution of a particular case due to a given cause, and fails to allow for the differences in amount of destitution of the different cases. The degree of want in each instance, however, cannot even be approximated. If the only ideally correct method of indicating the relative weight of causes be insisted on, the case-counting method becomes impossible.

If it be granted that it is legitimate to follow Warner, Simons, and others in treating all cases as of equal value, the results are yet inevitably so incomplete and subject to such large allowance for possible errors as to be worthless for scientific purposes. First, be it observed that not all the destitute of any community or country are taken, but only certain groups, as, for instance, charity organization society cases and almshouse inmates. Out of these groups can be selected only those individuals or families concerning whom the recorded information has an appearance of completeness. Transient cases cannot be considered. The group of cases investigated constitutes a small fraction of the whole number of the destitute, and may be not at all representative. Moreover, the different studies of this kind cannot be combined. Between the two groups hitherto studied, almshouse inmates and charity organization society cases, there are important differences. The families or individuals that the societies have under treatment for some length of time and concerning whom, therefore,

the information gathered is sufficient to permit an entry in the "statistical blank," are ordinarily of a distinctly higher grade than the "sodden driftwood" of the average almshouse. If the numerical data concerning these two groups are to be combined, each group must be "weighted" according to the percentage it constitutes of the whole number of the destitute. Owing to insufficiency of data and differences of classification and terminology, such combination of results is, and for a long time will be, unattainable. The study of charity organization society cases only is pursued, in this country, in such manner as to promise results, and to this group the following discussion of the case-counting method will be confined. That it is difficult to secure adequate information even concerning these cases no one who has had experience in investigation and relief work can deny. The subjects of investigation, the human beings designated as *cases*, may have reasons for deception and concealment, and at all events their testimony concerning themselves, one of the main sources of information, is biassed and incomplete. It should further be observed that "investigations" or "visits" are made primarily not for a scientific, but for a practical purpose, by overworked, hurried, and sometimes inexperienced agents. A very small number of facts concerning an individual or family may be decisive as to the practical measures to be taken. These entered on the "record card" do not present to the statistician looking for data to tabulate a sufficiently complete view of the condition and history of the family or individual to warrant inferences in regard to the cause of distress. Many a practical worker, seeing how decisive facts may remain undiscovered till almost the very close of the investigation or course of treatment, must have been haunted by the thought that perhaps one hour more devoted to some case might have revealed facts overthrowing the conclusions reached, and that serious mistakes may have been committed. Are we not all convinced by our own experiences that the decisive factors in the lives of many are so elusive that years of acquaintance may fail to disclose them? Somewhere, however, because of the merciless flight of time,

an investigation must be closed and the incomplete record allowed to stand.

Some factors, because not easily discovered, are credited with too small a proportion of cases, and, unless these cases are assigned to the caption "Unknown," the percentages left to other causes are thereby unduly increased. In Warner's table "crime and dishonesty" are credited with 3 per cent. from Cincinnati in the year 1891–92 (but only .7 per cent. for the previous year), and from other cities are not held to account for more than 1.5* per cent. in any year, and for most years no figure appears under this head. These numbers certainly give no adequate idea of the many who fail to keep employment because of petty acts of dishonesty or because they are *felt* to be unreliable. Concerning the numerous suspected but not proven acts no testimony whatever is likely to reach the charity organization society visitor. Even flagrant offences are not willingly disclosed by those who have detected them. The inquirer is frequently impressed by the unwillingness of employers to disparage the character of persons they have discharged and would not be willing to employ again. Another striking example of a forgotten cause is *immorality.* No percentage whatever is attributed to it in the charity organization society cases, and the heading "Immorality" in Warner's table serves no purpose except to include Mr. Booth's data concerning English paupers. Health and character are so undermined by this cause that unemployment and destitution are highly probable results. That it is wide-spread there are grounds for suspecting. Certain evidence, however, is not to be obtained. In spite of widely prevailing cynicism the charity visitor seeking information finds a remarkable reticence. Men and women are only suspected, not convicted, of sexual license. What charity worker would venture to set down such a suspicion in black and white? How many there are that would hesitate to record even certain knowledge! The record cards of charity organization societies, therefore, contain no evidence of this wide-spread and active cause of poverty.

* The highest percentage, it will be observed, in Professor Lindsay's table.

And now we come to the fundamental difficulty of the case-counting method. It has employed data for only a small proportion of the world's destitution, and incomplete information at best in all cases. Yet, if all the facts open to observation and record were given, their *interpretation* would meet insuperable difficulties. How is one to pick out a "principal" cause from a tangle of interacting forces? Take this entirely possible instance suggested by A. M. Simons:*—

"The husband, a not very competent workman, and an occasional drinker, is thrown out of employment by the stopping of the factory where he has been working. A child falls sick; owing to defective drainage, and this unusual expense causes him to allow his trades-union dues to lapse just before a period of general financial depression. Discouraged and tired of 'looking for work' and his resources exhausted, he applies for charity. Is the 'cause of distress' lack of employment, incompetency, intemperance, sickness, bad sanitation, trade-unionism, or 'general social conditions' beyond the control of the individual?"

How far back of the immediate cause is it permissible to go? Warner holds that the method should deal only with immediate causes, and therefore objects to the inclusion in the list of causes of "pauper association and heredity" and of "nature and location of abode." "Both of these," he states, "are by their nature predisposing causes rather than immediate or exciting causes; and it is confusing to mix the two." Dr. Ayers,† however, in discussing the new blank prepared by the committee of the National Conference, advises that:— "In cases where it is doubtful which of several causes should be indicated, some within and some outside the family, the emphasis should be thrown upon the primary cause, st it is surely known and can be stated. A suggestion from the Baltimore Charity Organization Society may be safely followed: 'Give the cause that is farthest back provided you really know it!'" Evidently there is no agreement as to the object of the inquiry.

* *American Journal of Sociology*, vol. iii. † *Charities Review*, December, 1898.

In many instances the chain of causes appears to return upon itself, the effect becoming a cause and forming, in a sense, a "vicious circle." A man is destitute because of unemployment, unemployed because of physical weakness, weak because of nature of abode and insufficiency of nutritious food, confined to insanitary dwelling-places and poorly fed and depressed because of his destitution. What point in this circle should be selected for tabulation? Obviously, the latitude that must be given to individual judgment puts agreement out of question. The individual judgments, though issuing in a numerical statement with all the delusive aspect of exactness that "figures" give, are the outcome of a struggle in the investigator's mind between indeterminate factors. Prejudice or, in more courteous phrase, the "personal equation" decides what part of a circular causal movement will be designated or how far back of the immediate causes the inquiry will be pushed. Moreover, the investigator's judgment is not likely to be entirely undisturbed by strong feeling. In regard to the subject of intemperance, for instance, an American until recently found it difficult to think calmly. He abominated either the liquor traffic or the frenzied language of the temperance advocate. That the bias of one student will exactly offset that of another is by no means certain.* The nature and amount of popular discussion given to any factor largely determines the bulk it assumes in each investigator's mind. Intemperance as a cause of destitution cannot be disregarded. "Nature of abode," however, has been overlooked. The small percentage of cases attributed to it (2.2 and 1 at the highest in Warner's and Lindsay's tables, respectively, and nothing for most cities) will astonish any one acquainted with the life of tenement districts. The attention given to housing conditions in recent years and the impression made upon the public mind will possibly be reflected in future tabulations, and result in some approach to a correct

* Professor Warner refers to the tendency of bias to become corrected in grand totals, and then suggests that variation is, after all, rather slight. Thus "causes indicating misconduct vary only between 7.5 and 32.5." This *only* is almost ludicrous. If variations of 25 points are to be regarded as trivial, the use of numerical data can have little meaning.

percentage. Such tables are, however, at best but records of the more or less confused impressions and reactions of more or less prejudiced minds. They indicate the course of popular thought and feeling, of subjective rather than of objective conditions. They can never give a rightly proportioned picture of the facts. How widely they depart from the reality it is idle to inquire.

A statistical blank such as that formerly recommended by the National Conference is, by its very nature, misleading. Consisting of a list of causes, headings under which data are to be entered, its use can be defended only on the assumption that the list is exhaustive so far as causes that can be considered *principal* are concerned, or that the omitted causes are a negligible quantity. Such listing leads to the oversight of causes not listed. The caption "Causes not named or unknown" is an insufficient safeguard. Placed at the end of the list, it attracts too little notice. Attention is inevitably centred upon the more conspicuous headings. The causes indicated by them occupy the mind at the outset of the inquiry, and, as in all human observation, what is expected and, therefore, almost desired, is, of course, discovered. Nothing would be gained, however, if each student were to make his own list of causes. Uniformity of terminology (that is, a statistical blank) is necessary if there is to be any tabulation of the combined results of different investigators. The very means necessary to a statistical study, however, renders it impossible to indicate the true proportions of *all* the factors creating destitution. A blank form, therefore, should not be used in a study of the entire subject. At best, a blank could exhibit the relative *prominence*—not relative *importance*—of a small number of causes. For such a purpose the proposed blank of the National Conference could be adapted by the omission of causes that are inconspicuous.* The difficulty of securing accurate and complete data and of interpreting

* Dr. Ayers states that the committee of the Conference revising the statistical blank in 1898 "was guided by the opinion that those headings in the old form that had shown only very small percentages should either be omitted or joined with other headings."

them, however, makes it clear that even the attempt to compare only a few conspicuous causes can lead to no trustworthy conclusions.

The case-counting method, we may conclude, is, and always will be, a complete failure. Comparing causes, not by any possible accurate measure of their effects, but by counting cases and assuming that they are of equal value; taking into consideration only a small proportion of the total of cases without assurance that those taken are truly representative of the whole; based for the cases actually investigated on incomplete data and on the untenable assumption that a principal cause may be picked out from a tangled network of causes; limited artificially to a printed list of causes suggested by the dominant interests of the time in advance of any real investigation,—it throws light neither on what is fundamental nor on the relative importance of the superficial phenomena and it gives no adequate study of any distinct class of the destitute or trustworthy comparison of any special groups of causes. It follows, as a matter of course, that it can yield no conclusion of sufficient generality to be of service in establishing principles of poor-relief. A few factors, indeed, in such a study acquire prominence,—intemperance, matters of employment, sickness. That these are in numerous cases among the immediate causes of distress may be granted. General observation will lead to that conclusion, and statistical proof is unnecessary. The only legitimate inference, however, is that of all the forces at work they are the conspicuous ones. It is not proved that they are the most important.

Warner appears to draw a general conclusion from his statistical study by selecting from the list of causes those of large percentages (intemperance, sickness, etc.) and showing that these imply *weakness*, physical, mental, or moral. He concludes that "the commonest exciting cause of the poverty that approaches pauperism is incapacity. Weakness of some sort is the most typical characteristic of the destitute classes." Almost every cause in the entire list, however, whether numeri-

cally prominent or not, could, by a similar method of reasoning, be shown to rest on weakness. The numerical data, therefore, are not necessary to the conclusion. Given merely a list of causes, such as may be obtained by general observation, an analysis of the list will show personal weakness as an all-pervading element. Objection may be made to Warner's conclusion, moreover, not only on the ground that it is reached by unnecessary and faulty statistical operations, but that it is incomplete. Analysis carried further will show that weakness is relative to the forces with which personality must contend; *i.e.*, the environment. The fundamental factors could be grouped under "personality" and "environment," but which group is the more important it is not possible to determine.*

The writer does not wish to imply that all study of concrete cases of destitution is without value. It is to the attempt

* Some publications of later date than those considered above indicate that doubts are beginning to arise in regard to the value of the case-counting method. Professor T. S. Adams (Adams and Sumner, "Labor Problems," 1905, p. 150), citing Warner's data, remarks that "such figures can never reveal the fundamental or original causes of poverty, and they must be used with great caution." Professors Mayo-Smith and Giddings, in reporting as a committee in 1899 on an investigation of this kind, say: "The committee does not lay any particular stress on the results of this inquiry. The question seems to be too difficult for the rough method of statistics." (Seventeenth Annual Report of the C. O. S. of New York City, p. 61.) A report of the Committee on Social Research of the New York Charity Organization Society (Twenty-third Annual Report, p. 86) declares a study based on opinions or impressions of charity organization society agents in regard to principal causes of poverty to be "unscientific." "It is felt that much more valuable results will follow from a study of actual conditions, such as sickness, lack of work, and drunkenness. . . . By carefully noting the associated conditions in every case, and tabulating the number of instances of such associated conditions, it will be possible to arrive, in the course of time, at a knowledge which shall be based on facts, and not on impressions." In future reports the committee hopes to establish "correlations" between "conditions and circumstances," which "will form a basis for conclusions as to causes." Here appears a lingering hope that statistical study may yet lead to conclusions. In recent years the Committee on Statistics of the National Conference of Charities and Corrections has not countenanced the case-counting method. "Most of us," writes one member, "have come to see that the old method of studying causes of poverty was an unfortunate one. . . . It was unfortunate for two reasons: first, because it meant reliance on opinions, not on facts; and, second, because the burden of deciding whether it was intemperance, lack of work, unwise philanthropy, inefficiency, or illness in a given case that brought the family to dependence, and the conviction that the decision could not be of much value, did much to make statistics in general hateful to charity workers." (Lilian Brandt in Proceedings of the National Conference, 1906, p. 426.) The schedule drawn by the committee and adopted at the Minneapolis meeting in 1907 did not use the old blank as a model. In fact, it was merely "designed to exhibit the general activities of societies dealing with needy persons in their homes," and calls for such data as number of cases dealt with, expenditures, number of volunteer workers, etc.

to *measure* causes that objection is made. If not cribbed and confined by a statistical schedule to specifically listed causes, it is possible that the study of concrete data may lead to the discovery of neglected factors or causes as yet unknown. A detailed study of individuals or families, a monographic method like that of the Le Play School, may prove useful. In providing a starting-point for an effort to trace causal antecedents in the chain and network of forces, such studies may contribute more to the satisfaction of the scientific temperament and to the illumination of the problem of poor-relief than any attempt at the measurement of the area over which given causes act. When we consider how causes are interlaced, how interdependent and inseparable are individual and environment, racial trait and social structure, it appears impossible to make any statement of the importance of causes in terms of relative magnitude. The only general conclusions of value, in the opinion of the writer, that can be drawn from a study of the causes of poverty, refer to the permanency or removability of the different forces at work. Nothing is really permanent, but what in a comparative sense may be called permanent factors constitute fixed points, hard facts, to which the practice of poor-relief must accommodate itself. The removable, on the other hand, should be studied with reference to the method, and perhaps in some cases the desirability, of removing. This is the point of view suggested, when it is borne in mind that, after all, the chief motive in a study of the subject is the desire to find guiding principles in the relief of human suffering.

REVIEWS.

Annual Report of the Department of Health of the City of Minneapolis for the Year ending December 31, 1907.

This report is noticed here because it illustrates a common fallacy in vital statistics. On the first page of the report the Commissioner of Health makes the following statements: "The total number of deaths for the year was 2,959, 135 more than were recorded during 1906. Deducting babies under one week of age, violent deaths, and deaths of non-residents who are brought into our hospitals for treatment, computed on an estimated population of 300,000, the death-rate per thousand is 8.56. This makes Minneapolis the healthiest city in the United States, as no other city of its size can show so low a death-rate."

There have been many attempts on the part of health officers to make an exceptionally good showing by misstatements of facts or by the use of fallacious methods of calculating death-rates. For a statement in three sentences, however, embodying four fallacies to reach a doubtful conclusion, the above quotation is quite typical.

First, it may be asked why the estimated population of Minneapolis was limited to 300,000? To be sure, the Census Office at Washington by their methods would give the city credit for only 285,676 population, or 14,324 less than the above guess of 300,000. While guessing, however, it would be just as easy to make the population 350,000 as 300,000, and it would make the city appear to be healthier.

Second, why stop with the elimination of the deaths of children under one week of age? As this is a purely arbitrary deduction, why not strike out the deaths of children under two, or, better, four weeks of age? This would obviously make the city appear to be considerably more healthy, and possibly Minneapolis would then become the most healthy city in the world. If the health of a city is to be determined by statistical juggling, then the more slow and tedious sanitary processes used in some of the less healthy cities of the United States could be discarded. Why, for instance, attempt to improve milk and water supplies, rigidly inspect food supplies, clean streets, etc., when an easier method yields quicker results?

Third, why deduct deaths from violence from the grand total in calculating the general death-rate? As a matter of fact, some deaths classi-

fied as violent are dependent, to some degree at least, upon climate and other local factors. For example, deaths by sunstroke are classified as violent deaths, but it is obvious that this cause varies in importance with local conditions, including climate. Some authorities, too, presume to think that there is a more or less intimate relation between disease prevalence and accidents. If it is proper to deduct deaths by violence from the grand total of deaths to make a city appear to be healthy, it may be suggested, for the benefit of a rival city, that it would be just as logical to deduct deaths from ill-defined causes, deaths due to old age, and that considerable number of deaths reported as due to "heart failure." If a person dies of old age in a given city, that, of itself, is one of the surest signs that the city is healthy. So why should the death count against the fair reputation of the city by being included in the calculation of its death-rate? Death by "heart failure" may or may not be due to general health and sanitary conditions; but why not give the city the benefit of the doubt, and throw them all out? Obviously, such ill-defined causes as dropsy, found dead, sudden death, etc., should all be eliminated in the manufacture of a healthy city.

Fourth, deaths of non-residents are eliminated from the death-rate calculations in Minneapolis. If care was taken to include in the death-rate (or, better, health-rate) all of the residents of Minneapolis who happened to die outside of the city and some of whose bodies would almost certainly be interred elsewhere, then it might have been excusable to deduct the deaths of non-residents treated in Minneapolis hospitals. It is a poor rule, however, which does not work both ways.

Finally, it may be asked whether the children under one week of age, the non-residents and the decedents by violence, were all carefully deducted from the estimated population. A novice in mathematics can easily see that, if they were not permitted to appear in the dividend, they should also have been cast out of the divisor in the calculation of the "corrected" death-rate. The report does not indicate how many non-residents and children under one week of age died in Minneapolis during 1907. These omissions make it impossible to judge of the importance of the two items, but the 300,000 estimate of population must have included all infants, non-residents, etc., with a few others added for good measure.

A few other cities, notably New York in its weekly health reports, publish what they are pleased to call "corrected" death-rates, in the calculation of which deaths of non-residents and infants under one week of age are excluded. This method, however, is not favored by the highest authorities in vital statistics, and there does not appear to be one sound argument in its favor. In any event the "uncorrected" death-rates should be given, as in the New York reports, so that fair comparison can be made with other cities. To say the least, it is un-

fair to the other less healthy cities to be branded without the chance to get at the real facts in the case.

The writer has no sympathy with attempts to mislead the public by juggling with the death returns. Minneapolis is a comparatively healthy city when judged by its annual death-rate as calculated by the standard methods. Whether it is or is not "the healthiest city in the United States" is a matter of some doubt and less importance. Other cities could doubtless materially improve their published death-rates if, as we hope they will not, they were to copy the fallacious methods used by the Commissioner of Health of Minneapolis. F. S. CRUM.

A LIST OF RECENT STATISTICAL PUBLICATIONS.*

By Thomas J. Homer.

I.

Theory and Method.

Beneduce, Alberto. Rassegna del movimento scientifico. Statistica. (In *Giorn. d. econ.*, April, 1908.)

Discusses the recent work of Karl Pearson, Wm. Palin Elderton, and F. P. Cantelli.

Benini, Rodolfo. Principii di statistica metodologica. Torino: Unione tipogr. 1906. 353 pp. 8°.

Reviewed in the *Giornale degli economisti*, ser. 2, vol. 32, p. 586. Rome.

Bertillon, Jacques. Curso elemental de estadística administrativa. Obra ajustada al programa acordado por el Consejo superior de estadística para el examen de ingreso en las diversas oficinas públicas. Traducido por Antonio Revenga. Madrid: Reus. 1907. 635 pp.

Bowley, Arthur Lyon. Elements of statistics. 3d edition. London: King. 1908. 348 pp. 8°.

Bruns, Ernst Heinrich. Wahrscheinlichkeitsrechnung und Kollektivmasslehre. Leipzig: Teubner. 1906. viii, 328 pp. 8°.

Deals with the "doctrine of collective quantities"; and discusses the representation of statistical frequency by a series.

Caroncini, Alberto. Note di metodo sulla statistica degli scioperi. (In *Giorn. d. econ.* for Dec., 1905, and Jan., 1906.)

Conference [8th] of Statisticians of the Commonwealth and States of Australia and Colony of New Zealand. Melbourne, Nov. and Dec., 1906. Australasia. Unification of Australasian statistical methods and co-ordination of the work of the Commonwealth and State Bureaus. Melbourne: Kemp. 1906. 73 pp. Fol.

Rev. in *Royal Statistical Society. Journal.* Vol. 70, p. 663. *See also* p. 582.

* This list, which will be continued in the December issue, does not pretend to be exhaustive or critical; but it is hoped that it may prove serviceable for purposes of reference. The several other classes of statistical publications will be dealt with in future numbers.

CONTENTO, ALDO. La statistica del movimento migratorio e il calcolo dell' aumento della popolazione. (In *Giorn. d. econ.*, Rome, for Nov., 1906.)

DILKE, CHARLES W. [On official statistics.] Presidential address (Royal Statistical Society). (In *Roy. Stat. Soc. Journal*, vol. 70, pp. 553–582. London.)

"A plea for co-ordination of official statistics and statistical methods."

EDGEWORTH, F. Y. On the representation of statistical frequency by a series. (In *R. S. S. Journal*, vol. 70, pp. 102–106. 1907.)

——. On the probable errors of frequency-constants. (In *R. S. S. Journal*, vol. 71, pp. 381–397. 1908.) *To be continued.*

ELDERTON, WILLIAM PALIN. Frequency-curves and correlation. Published for the Institute of Actuaries. London: Layton. [1906.] xiii, 172 pp. 8°.

Books, references, etc., pp. 163–165. Rev. in *R. S. S. Journal*, vol. 70, p. 132.

FORNASARI DI VERCE, E. Statistiche agrarie; studio di metodologia statistica. (In *Giorn. d. econ.*, Rome, for Sept. and Oct., 1906.)

GRYZANOVSKI, ERNST G. F. On collective phenomena and the scientific value of statistical data. (In *American Economic Association. Publications.* 3d ser., vol. 7, no. 3. 1906.)

With an introduction by Frederick Tuckerman.

JACQUART, CAMILLE. Statistique et science sociale. Aperçus généraux. (Conférences données à l'Institut supérieur de philosophie de Louvain.) Bruxelles: Desclée, De Brouwer & Cie. 1907. 120 (1) pp. 16°.

JAECKEL, REINHOLD. Zur Bevölkerungsstatistik und Bevölkerungswissenschaft. (Unter Zugrundelegung der neueren Literatur.) 1907. 45 pp. 8°.

KAPTEYN, JACOBUS CORNELIUS. Statistical methods in stellar astronomy. Diagrams. (In Congress of Arts and Science.... St. Louis, 1904. Vol. 4, pp. 396–425. Boston. 1906.)

KNIBBS, GEORGE HANDLEY. The classification of disease and causes of death, from the standpoint of the statistician. Melbourne: Intercolonial Medical Journal. 1907. 24 pp. 8°.

Rev. in *R. S. S. Journal*, vol. 70, p. 662. The author is "Commonwealth Statistician."

LAURENT, HERMANN. Statistique mathématique. Paris: Doin. 1908. vi, 272 pp. 8°.

Rev. in *R. S. S. Journal*, vol. 71, p. 406.

MALLET, BERNARD. A method of estimating capital wealth from the estate duty statistics. (In *R. S. S. Journal*, vol. 71, pp. 65–84. 1908.)

MICHEL, E. Statistiques et monographie. Lecture à l'Association normande (Congrès de Bayeux, 1906). Caën: Delesques. 1907. 11 pp. Tables. 8°.

NINA, L. Principî fondamentali di statistica. Turin: Bocca. 1907. 182 pp. 8°.

PEARSON, KARL. On further methods of determining correlation. London: Dulau. 1907. 39 pp. 4°.
Rev. in *R. S. S. Journal*, vol. 70, p. 655.

PRATO, GIUSEPPE. Rassegne statistiche ed economiche. Turin: Soc. tip. editr. nazionale. 1908. 313 pp. 16°. [University of Turin. Economic laboratory studies. 3.]
A work on statistical theory and practice.

SCHNAPPER–ARNDT, GOTTLIEB. Sozialstatistik. (Vorlesungen über Bevölkerungslehre, Wirtschafts- und Moralstatistik.) Leipzig: Klinkhardt. 1908. xxii, 642 pp. Illus. 8°.
Edited by Dr. Leon Zeitlin. Rev. in *R. S. S. Journal*, vol. 71, p. 222; and in the *Economic Bulletin* for April, 1908, p. 52.

UNITED STATES. *Census Bureau.* Modes of statement of cause of death and duration of illness upon certificates of death. Comparison of forms . . . [with those of] other countries and suggestion of a modification of the standard certificate to secure uniform and definite statements of causes of death. [Washington. 1907.] 81 pp. Map. Facsimiles. 8°.
Check list of registration officials, and of reports and bulletins containing vital statistics in the United States, pp. 71–81.

UNITED STATES. *Census Bureau.* Special reports. Supplementary analysis and derivative tables. Washington. 1906. xviii, 1144 pp.
A special supplementary report on the 12th Census, prepared under the supervision of Walter F. Willcox,—an analysis and interpretation of statistics (particularly those of population) contained in the main reports.

WEBB, Mrs. SIDNEY. [Methods of investigation.] (In *Sociological papers.* Published for the Sociological Society. Vol. iii. London. 1907.)
Briefly discusses "the function of statistical method in sociology."

WELLS, FREDERIC LYMAN. Statistical study of literary merit, with remarks on some new phases of the method. New York: Science Press. 1907. 30 pp. Diagrams. 8°.

ZIMMERMAN, FRIEDRICH W. R. Die deutsche Handelsstatistik in ihre geschichtlichen Entwickelung und ihrem derzeitigen

Stand. (In *Jahrbücher für Nationalökonomie und Statistik.* Jena. Concluded in the issue for April, 1908.)

II.

Current Periodicals.

ABBREVIATIONS.

Bi-m. = Bi-monthly.	Semi-a. = Semi-annually.
Irreg. = Irregularly.	Semi-m. = Semi-monthly.
M. = Monthly.	W. = Weekly.
N. s. = New series.	Y. = Yearly.
Q. = Quarterly.	

Allgemeines statistisches Archiv. Herausgegeben von Georg von Mayr. Tübingen. Semi-a. 1890+.

American Statistical Association. Boston. Publications. N. s. Q. 1888+.

Archiv für Sozialwissenschaft und Sozialpolitik. *Formerly called* Archiv für soziale Gesetzgebung und Statistik. Begründet v. Heinrich Braun. Herausg. v. W. Sombart, M. Weber, und E. Jaffé. Tübingen, Berlin. Q. 1888+.

The Bankers', Insurance Managers', and Agents' Magazine. [The Bankers' Magazine.] A journal of banking, actuarial and financial statistics. London. M. 1844+.

Biometrika. A journal for the statistical study of biological problems. Edited, in consultation with Francis Galton, by W. F. R. Weldon, Karl Pearson, and C. B. Davenport. Cambridge (Engl.). Q. 1901-02+.

Bulletin russe de statistique financiére et législation. St. Petersburg. M. 1894+.

Deutscher Rundschau für Geographie und Statistik. Wien. M. 1879+.

Frankfurter Verein für Geographie und Statistik. Jahresbericht. Frankfurt am Main. Y. 1836+.

Institut International de Statistique. Bulletin. Rome. Irreg. 1885+.

Jahrbücher fur Nationalokonomie und Statistik. [Conrad's.] Begründet v. Bruno Hildebrand. Jena. M. 1863+.

Journal des économistes. Revue mensuelle de la science économique et de la statistique. Paris. M. 1843+.

Manchester Statistical Society. Transactions. Manchester (Engl.). Y. 1887-88+.

MONATSSCHRIFT FÜR KRIMINAL-PSYCHOLOGIE UND STRAFRECHTSREFORM . . . Hrsg. v. . . . Gustav Aschaffenburg. Heidelberg. M. 1904+.

Gives special attention to criminal statistics, particularly to the discussion of official criminal statistics.

REVUE DE STATISTIQUE. Paris. W. 1898+.

ROYAL STATISTICAL SOCIETY. Journal. London. Q. 1838+.

SAMMLUNG NATIONALÖKONOMISCHER UND STATISTISCHER ABHANDLUNGEN DES STAATSWISSENSCHAFTLICHEN SEMINARS ZU HALLE A. D. S. Hrsg. v. Joh. Conrad. Jena. Irreg. 1877+.

SOCIÉTÉ DE STATISTIQUE DE PARIS. Journal. Paris. M. 1860+.

STATISTICAL AND SOCIAL INQUIRY SOCIETY OF IRELAND. Journal. Dublin. Y. 1855+.

THE STATISTICAL SOCIETY OF SOUTH AFRICA. Publications. Johannesburg. 1907+.

STATISTISK TIDSKRIFT: UTGIFVEN AF KUNGL. STATISTISKA CENTRALBYRÅN. Stockholm. 1862+.

STATSVETENSKAPLIG TIDSKRIFT FOER POLITIK, STATISTIK, EKONOMI. Upsala. 1897+.

VEREENIGING VOOR DE STAATHUISHOUDKUNDE EN DE STATISTIEK. Verslag van de algemeene vergadering, gehouden te Amsterdam den 5en October 1907. Amsterdam: Joh. Müller. 24, 70 pp. Roy. 8°.

ZEITSCHRIFT FÜR SCHWEIZERISCHE STATISTIK. (Schweizerische statistische Gesellschaft und Eidgenossisches statistisches Bureau.) Berne. Irreg. 1865+.